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Description of a New Species of Tree Frog from México Studies of American Hylid Frogs VI

WILLIAM E. DUELLMAN

Field studies on hylid frogs in southern México in the summer of 1960 revealed the presence of several novelties, not the least of which is a large species of *Hyla* that was discovered in the cloud forests on the Atlantic slopes of the Chiapan Highlands. Individuals of this species were found on vegetation at waterfalls at night and in holes behind waterfalls by day. Indian folklore in southern México contains a legend about leprechaun-like creatures, chaneques, that live behind waterfalls by day and venture forth only at night. Other habits attributed to the chaneques notwithstanding, the name of this mythological creature is here associated with the unnamed species of hylid frog described below:

Hyla chaneque new species

Holotype.—University of Kansas Museum of Natural History No. 58439, from a stream above (6.2 kilometers by road south of) Rayón Mescalapa, Chiapas, México (elevation 1690 meters); obtained on August 5, 1960, by William E. Duellman. Original number WED 17376.

Paratypes.—KU Nos. 58440-3 from the type locality and KU 58444 from 5.6 kilometers south of Rayón Mescalapa at an elevation of 1680 meters.

Diagnosis.—A large (maximum known snout-vent length, 79 mm.), broad-headed *Hyla* having a strong tarsal fold, large feet that are nearly fully webbed, many well-developed supernumerary tubercles, an anal sheath extending to middle of thighs, a dark gray venter, and no vocal slits.

Description of Holotype.—Adult male having a snout-vent length of 57.7 mm.; tibia length, 28.8 mm.; tibia length/snout-vent length, 49.9 per cent; foot length (measured from the proximal edge of inner metatarsal tubercle to tip of longest toe), 25.3 mm.; head length, 19.5 mm.; head length/snout-vent length, 33.8 per cent; head width, 19.5 mm.; head width/snout-vent length, 33.8 per cent; diameter of eye, 6.3 mm.; diameter of tympanum, 2.8 mm.; tympanum/eye, 44.4 per cent. Snout in lateral profile obtusely rounded, in dorsal profile rounded with square tip (Fig. 1); canthus pronounced, rounded, not angular; loreal region moderately concave; lips thick and flaring; nostrils protuberant laterally; internarial distance, 5.9

Fig. 1.—Holotype of *Hyla chaneque* (KU 58439). × 1½.

mm.; interorbital distance, 6.3 mm., somewhat broader than width of eyelid, 5.7 mm. A heavy dermal fold from posterior corner of eye above, and concealing upper part of tympanum, extending to insertion of forearm; tympanum

round, its diameter equal to two-thirds its distance from eye. Forearm moderately robust; a row of small tubercles on ventrolateral edge of forearm and extending onto outer finger; no fold on wrist; inner surface of greatly enlarged prepollex covered with horny excrescence; subarticular tubercles large and round; none is bifid; many round supernumerary tubercles on palm and proximal segments of digits; diameter of disc on third finger about equal to diameter of tympanum; fourth finger slightly longer than first; rudimentary web between first and second fingers; others about one fourth webbed (Fig. 2). Heels overlap by about one-third length of tibia when hind limbs adpressed; tibiotarsal articulation extends to middle of eye; a strong tarsal fold; inner metatarsal tubercle large, rounded, elliptical in ventral profile, and

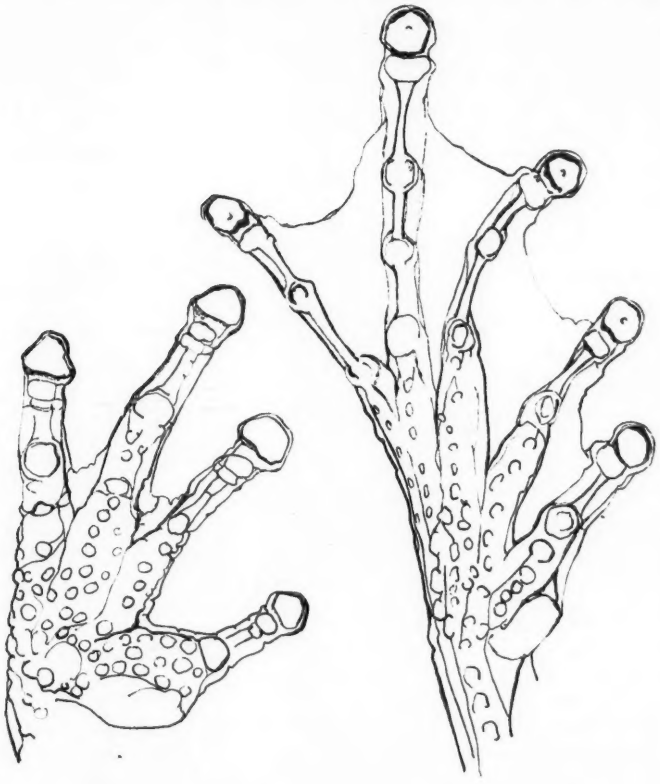

Fig. 2.—Ventral views of hand and foot of *Hyla chaneque* (KU 58439). × 4.

visible from above; no outer metatarsal tubercle; subarticular tubercles round; many supernumerary tubercles on soles and proximal segments of digits; third and fifth toes subequal in length; fourth toe webbed to base of penultimate phalanx, others to base of disc; discs about two-thirds size of those

on fingers. Anus directed posteroventrally at middle of thighs; a heavy anal sheath bordered on each side by a heavy fold of skin and below by large tubercles. Skin of dorsum smooth; scattered tubercles on back, but most numerous on head; ventral surfaces moderately granular; posteroventral surfaces of proximal two-thirds of thighs heavily granular. Tongue ovoid, shallowly notched behind, and barely free posteriorly; vomerine teeth 7-7, situated on posteroventral edge of transverse vomerine ridge between the much smaller round inner nares; no vocal slits.

Color (in alcohol) purplish gray on dorsal surfaces of head, body, and limbs; irregular black spots on head and body; spots narrowly outlined with gray; black transverse bands of varying widths on dorsal surfaces of limbs; fingers (except thumb, which is a dusty cream color) and toes dark purplish gray; webbing on feet grayish brown; nuptial adspersities on thumbs brownish black; flanks dusty tan with purplish black spots; posterior surfaces of thighs dark brown; ventral surfaces creamy gray, darkest on chin and thighs; soles of feet and palms of hands gray.

Color (in life) dull green above with dark olive-brown spots on flanks and back and olive-brown transverse bands on limbs; flanks creamy green; posterior surfaces of thighs dark brown; venter dull creamy brown; throat spotted with brown; iris bronze with brown reticulations.

TABLE 1

Variation in size and proportions of *Hyla chaneque*.

KU No.	Sex	Snout-vent (in mm.)	Head Width Snout-vent (in per cent)	Interorbital Head Width (in per cent)	Tympanum Eye (in per cent)
58439	♂	57.7	33.8	32.3	44.4
58440	♂	60.7	31.6	35.4	42.4
58441	♂	60.2	31.7	33.0	43.9
58443	♂	59.8	31.8	34.2	41.8
58444	♂	56.0	33.9	32.1	41.9
58442	♀	79.3	32.3	30.1	45.4

Variation.—The variation in measurements and proportions is given in Table 1. Aside from the minor individual variation in proportions displayed by the small sample, the only other structural variation worthy of comment is the disposition of the dorsal tubercles. Tubercles are prominent on the head in all specimens. In three individuals the tubercles are well developed on the hind limbs. One specimen (KU 58441) has well-developed tubercles on the head, back, forelimbs and hind limbs. The number of vomerine teeth varies from 10 to 18; the smallest specimen (52.8 mm.) has only 10 vomerine teeth, and the largest specimen (79.3 mm.) has 18.

Coloration among the preserved specimens varies only slightly. The size and shape of the blotches on the dorsum vary, but in all specimens these blotches are present, as are the transverse bands on the limbs. One specimen (KU 58441) has a pale gray dorsum and grayish tan thighs and webbing; below it is pale creamy gray, whereas other specimens are noticeably darker.

In life, all of the males were varying shades of green above;

the one female (KU 58442), when collected, had dark brown markings on a reddish tan dorsum; later the frog changed to have olive-green markings on a greenish tan dorsum.

Comparisons.—The only other frog in México or northern Central America that might be confused with *Hyla chaneque* is *Hyla taeniopus*. As presently understood, *Hyla taeniopus* can be distinguished from *Hyla chaneque* by having a noticeably larger tympanum, less webbing on the feet, a smooth dorsum without tubercles, and strong sexual dimorphism in the shape of the snout. Males have a pointed and protruding snout, whereas females have a blunt, rounded snout.

Acknowledgments.—I am grateful to John Wellman for aid in obtaining these frogs. Field work was made possible by a grant from the National Science Foundation (NSF G-9827). The drawings were executed by Gail Selfridge.

Museum of Natural History, University of Kansas, Lawrence

Systematic Status of the Geckonid Lizard Genera *Gehyra, Peropus, Hoplodactylus* and *Naultinus*

Pete S. Chrapliwy, Hobart M. Smith
and Chapman Grant

In the seventy-five years following publication of the Catalogue of Lizards in the British Museum by Boulenger (1885-1887, 2nd ed.) the names *Gehyra* Gray and *Peropus* Wiegmann have been used interchangeably by various workers for the same species of geckos (for example, *Gehyra mutilata* and *Peropus mutilatus*). A survey of the history of these two names clearly reveals that the basis for choice is a zoological one, not strictly nomenclatural; that the two species groups involved are most reasonably to be considered separate genera *Peropus* and *Gehyra;* and that the history of treatment of these and other involved names has been a comedy of errors requiring rectification even yet in the disposition of the currently accepted generic names *Hoplodactylus* (which we change to *Naultinus*) and *Naultinus* (which we change to *Naultinulus*).

As pointed out by Malcolm Smith in 1933 (Rec. Indian Mus., 35:12-15), the generic name *Gehyra* and its monotype *Gehyra pacifica* were first proposed by Gray in 1834 (Proc. Zool. Soc. London: 100) and not in 1842 (Zool. Misc.: 57) as cited by Boulenger (1885, *op. cit.*, 1:147; 1912, Vert. Fauna Malay Peninsula, Rept. Batr.: 46). Curiously enough, the combination *Gehyra pacifica* did not appear again in the literature. The genus *Peropus* (monotype *mutilatus*) was proposed by Wiegmann in 1835 (Nova Acta Acad. Leop.-Carol., 17: 238).

The next event was the redescription by Gray in May, 1842 (Zool. Misc.: 57-58), of his genus *Gehyra*, in which, however, he included solely *Gecko oceanicus* Lesson 1830, under the name *Gehyra oceanica* (Lesson), with the synonyms only of *Hemidactylus oualensis* Bibron 1836 and a label name *Gehyra gularis* from specimens in the British Museum. Immediately following that account comes the original description of *Naultinus pacificus*, both genus and species new. Other unrelated forms are discussed subsequently.

Finally, at least among early works, Gray in a different article in the same journal (Zool. Misc.: 72), following the article cited above, redescribed the genus *Naultinus*, described a new species, *Naultinus elegans*, and stated that the genus contained a second species, "*N. Pacifica*."

Since the types of *Gehyra pacifica* Gray 1834 have never been found, it has been necessary to conclude that they are conspecific with *Gecko oceanicus* Lesson 1830 as implied by Gray's recognition in 1842 of only the species *oceanicus* in the genus *Gehyra*, despite the repugnant but lingering suspicion that perhaps, upon learning of Lesson's earlier name, Gray merely changed the name of the types of *Gehyra pacifica* to *Naultinus pacificus*, preferring for some obscure reason to use the generic name *Gehyra* for Lesson's species. Gray's puzzling reference (1842:72) to "*N. Pacifica*" lends some support to this suspicion, which through lack of significant evidence remains only a suspicion. The 1834 and 1842 descriptions are not sufficiently detailed to be conclusive.

Malcolm Smith (*loc. cit.*) concluded, as had Boulenger (1885, *op. cit.*: 168) before him, that the type species of *Naultinus* is "by elimination" *elegans*. McCann (1955, New Zealand Dominion Mus. Bull., 17:31) adopted Smith's view, under the mistaken impression that the material on *Naultinus* that actually appeared on page 72 of Gray's Zoological Miscellany followed the description of *Naultinus pacificus* on the same page (58) and in the same article. Had this been so the conclusion adopted by Smith and McCann would have been correct, but under the actual circumstances the type species can only be *Naultinus pacificus* Gray 1842, by monotypy, because although the date of publication is the same for *N. pacificus* and *N. elegans*, the two names appeared in different articles. Complete equality in eligibility for selection as type, with the choice of precedence falling to the first revisor, is granted only for names proposed in the same article.

The species *Naultinus pacificus* Gray 1842 has long been placed in the genus *Hoplodactylus* Fitzinger 1843, type *Platydactylus duvauceli* Duméril and Bibron. *Hoplodactylus* 1843, therefore, should be replaced by the earlier generic name *Naultinus* 1842.

The species *Naultinus elegans* Gray 1842 has remained throughout its history in the genus *Naultinus*, of which *elegans* was regarded the type species. Since, however, the type species actually is *pacificus*, which belongs in a different genus from *elegans*, another generic name is required for *elegans*. Since no synonym is available we here propose a new name, *Naultinulus;* McCann (*op. cit.*) has shown that *Heteropholis* of Fischer, 1882, type *H. rudis* Fischer 1882, is a genus distinct from that containing *elegans* with which Boulenger placed it.

Therefore, the synonymies of the genera *Naultinus* Gray 1842 (*Hoplodactylus auctorum*) and *Naultinulus* (*Naultinus auctorum*) stand as follows:

Naultinus Gray

Naultinus Gray, 1842 (May), Zool. Misc.: 58, type by monotypy *N. pacificus* Gray, 1842, *loc. cit.*; Gray, 1842 (May), Zool. Misc.: 72 (part only; not *N. elegans*).

Hoplodactylus Fitzinger, 1843, Syst. Rept.: 19, 100, type by monotypy *Platydactylus duvauceli* Duméril and Bibron; Boulenger, 1885, Cat. Liz. Brit. Mus., 1:171; Smith, 1933, Rec. Indian Mus., 35:13; McCann, 1955, New Zealand Dom. Mus. Bull., 17:35-56.

Pentadactylus Gray, 1845, Cat. Liz. Brit. Mus.: 160, type by monotypy *Platydactylus duvauceli* Duméril and Bibron.

Dactylocnemis Fitzinger *in* Steindachner, 1867, Reise d. ost. Fregatte Novara um die Erde: 11, type by monotypy *Naultinus pacificus* Gray.

Range.—Endemic to New Zealand.

Referred species.—According to M. Smith (*loc. cit.*) four species are recognized: *Naultinus pacificus* Gray, 1842; *Naultinus duvauceli* (Duméril and Bibron, 1836); *Naultinus granulatus* Gray, 1845 (*syn.*: *Naultinus grayi* Knox, 1870; *N. sylvestris* Buller, 1881; *N. versicolor* Colenso, 1885); and *Naultinus maculatus* Gray, 1845 (*syn.*: *Naultinus brevidactylus* Gray, 1845). McCann (*loc. cit.*) recognizes all these species except *maculatus*, which name (along with *brevidactylus*) he regards as a *nomen nudum*. On the contrary Gray did provide a description—however brief—with each name and, therefore, neither can be disregarded as a *nomen nudum*. However, McCann makes it abundantly clear from his description and discussion that both names should be considered as synonyms of *N. granulatus*, leaving but three species in the genus.

Naultinulus nom. nov.

Naultinus (*nec* Gray), Boulenger, 1885, Cat. Liz. Brit. Mus., 1:168; Smith, 1933, Rec. Indian Mus., 35:13; McCann, 1955, New Zealand Dom. Mus. Bull., 17:28.

Range.—Endemic to New Zealand.

Referred species.—One, the type, *Naultinulus elegans* (Gray, 1842) (*syn.*: *Naultinus punctatus* Gray, 1843; *N. grayi* Bell, 1843; *N. sulphureus* Buller, 1871; *N. pentagonalis* Colenso, 1880).

Having dealt with the extraordinary confusion surrounding the name *Naultinus*, let us return to *Gehyra* and *Peropus*.

Peropus Wiegmann 1835, having as its type (by monotypy) *P. mutilatus*, belongs to a large group of closely similar species all characterized by having the digital lamellae divided by a median groove. *Gehyra* Gray 1834, having as its type by monotypy

Gehyra pacifica Gray 1834 (=*Gecko oceanica* Lesson 1830), belongs to a small group of species all characterized by having the digital lamellae undivided, although otherwise the two groups of *Peropus* and *Gehyra* (*s.s.*) are closely similar. Boulenger, in fact (1885, *op. cit.*: 148), regarded the two groups as congeneric, using the earlier name *Gehyra* for the single genus. It is apparent that the question of proper names for these groups hinges exclusively upon the validity of the lamellar character. To evaluate this validity we have reviewed the literature on all species described of *Gehyra* (*s.l.*). In addition, we have examined a number of specimens of three critical species (see below), and we have summarized our findings as follows.

Boulenger in 1885 listed nine species of *Gehyra* (*s.l.*): *australis*, *baliola*, *brevipalmata*, *insulensis*, *mutilata*, *neglecta*, *oceanica*, *variegata*, and *vorax*. In addition, six species of *Peripia* (a synonym of *Gehyra*) described by Macleay (1878, Proc. Linnaean Soc. New South Wales, 2:97) from specimens collected in New Guinea by the "Chevert" Expedition were tentatively assigned to the genus *Gehyra* by Boulenger, who merely listed them in a footnote (p. 147). These New Guinea specimens will be discussed later. All of the nine species mentioned are still recognized except as follows. Burt (1932, Bull. Amer. Mus. Nat. Hist., 63:498-9) synonymized *G. vorax* Girard 1847 with *G. oceanica* (Lesson 1830). M. A. Smith (1935, Fauna Brit. India, Rept. Amph., 2:115) relegated *G. neglecta* (Girard, 1857) to the synonymy of *Lepidodactylus lugubris* (Duméril and Bibron 1836). Smith (1935, *op. cit.*: 105) also considered *G. insulensis* (Girard) 1857 a junior synonym of *G. mutilata* (Wiegmann), 1835. Loveridge (1934:313) placed *G. australis* Gray, 1845, as a subspecies of *G. variegata* (Duméril and Bibron, 1836).

Thirteen additional forms of *Peropus* and/or *Gehyra* have been described since Boulenger's 1885 catalog: *barea* Kopstein, 1926; *beebei* Annandale, 1913; *butleri* Boulenger, 1900; *fischeri* Strauch, 1887; *intermedia* A. E. Brown, 1902; *interstitialis* Oudemans, 1894; *lampei* Andersson, 1913; *larutensis* Boulenger, 1900; *leopoldi* Brongersma, 1930; *marginata* Boulenger, 1887; *marginata* Boettger, 1895; *variegatus punctatus* Fry, 1914; and *yunnanensis* Boulenger, 1903. Of these thirteen geckos only seven are currently recognized as valid. M. A. Smith (1933, *op. cit.*: 16) referred *larutensis* and *yunnanensis* to the genus *Hemiphyllodactylus* and he stated (1927, Proc. Zool. Soc. London: 215) that *beebei* is not separable from *G. mutilata*. Brongersma (1934, Zool. Med. Mus. Leiden, 17:174) resurrected *G. papuana* A. B. Meyer 1874 from the synonymy of *G. oceanica* and referred *G. lampei* to the synonymy of *G. papuana*. Boulenger (1887, Ann. Mag. Nat. Hist. (5), 19:383; and 1895,

Zool. Rec., Rept. Batr.: 17) placed *fischeri* Strauch and *marginata* Boettger as synonyms of *G. marginata* Boulenger.

Thus 13 species and subspecies, excluding the Macleay forms, are now known in the Boulengerian genus *Gehyra*. On the basis of Boulenger's partition of this assemblage into two groups—one with undivided lamellae (*Gehyra s.s.*) the other with divided lamellae (*Peropus*)—all fall with *Peropus* except three—*australis, oceanicus,* and *marginatus.*

Loveridge (1934, Bull. Mus. Comp. Zool., 77:312) is the only author presenting evidence of fallibility of the characters separating *Gehyra* and *Peropus.* He states: "the arrangement of the digital lamellae of (*P. v.*) *australis* show that it occupies an intermediate position between typical *variegatus* (digital lamellae divided by a median groove, hence a *Peropus* as defined by Gray) and *oceanicus* (digital lamellae undivided, hence a *Gehyra* as defined by Gray) both taxonomically as well as geographically."

Discussing *P. v. australis,* Loveridge (*op. cit.*:313) notes the "digital lamellae distally with more or less of a median groove which, however, does not separate them as in the typical form, their condition being intermediate between typical *variegatus* and *oceanicus* . . ." Curiously, however, Loveridge used the name *Peropus* for the combined groups, possibly through acceptance of 1842 as the date of proposal of *Gehyra* (as stated by Boulenger, 1885).

If the zoological conclusions of Loveridge were sound, then the name *Peropus* would indeed be untenable and the proper name for the genus would be *Gehyra* Gray, 1834, since that name antedates *Peropus* Wiegmann, 1835. Even as early a student as Boulenger (1885, *op. cit.*: 152) held that *australis* (of *Gehyra s. s.*) is almost identical with *variegata* (of *Peropus*) except in having entire instead of divided lamellae. In re-examining these forms, however, we are not so impressed with this supposed similarity as some previous workers have been. We have examined 8 *oceanica,* 16 *australis* and 31 *variegatus,* all from the Museum of Comparative Zoology and hence inclusive of the specimens examined by Loveridge. Although the lamellae of *australis* are more angularly V-shaped than in *oceanica,* duplicating the angularity of *variegatus,* in not a single *australis* are any lamellae of either foot or hand divided or grooved; some are slightly notched in the apex of the lamellar angle, but there is no groove whatever. Likewise in not a single *variegatus* is there doubt that all the lamellae in the expanded subdigital pads, on both hands and feet, are divided; the distal lamellae even overlap slightly at the median line, whereas the proximal lamellae are divided by a distinct longitudinal seam.

Moreover the supra- and interorbital scales in *australis* are extremely small, numbering about 45 in the shortest line (13-17 interorbitals); in *variegatus* the same scales are about twice as large, numbering about 30 (7-9 interorbitals). The head is differently shaped in the two species; in *australis* it is relatively flat, long and narrow, whereas in *variegatus* it is relatively thick, short and broad. The body and digital pads are somewhat larger in *australis* than in *variegatus*. In all these features *australis* agrees more closely with *oceanica* than with *variegatus*. Clearly the proposition that these forms are subspecies is untenable, particularly since the species seemingly overlap in geographic range. *G. australis* apparently is limited to northern Australia (Queensland, North Australia), but *variegatus* occurs in numerous localities both to the south and to the north of *australis* (in New Guinea, Polynesia, Queensland, North Australia and Western Australia) and, therefore, presumably occurs throughout the range of the latter species although precise records of sympatry are not known to us. We, therefore, here restore *australis* and *variegatus* to specific status.

These two species still have an important bearing upon the status of the two genera *Gehyra* and *Peropus*, because they are the two species most nearly alike in the two genera. The case for considering the two groups congeneric is based largely upon the reported similarity of *australis* and *variegatus*. It is true that *australis* has angular lamellae much like *variegatus*, yet there is in fact no intermediacy in division of the lamellae. Furthermore, *australis* appears actually to be more closely related to other species of *Gehyra* (*s. s.*) than to *Peropus*, not only in the entirety of the lamellae but in size of body, size of digital pads, size of scales on the head, and head proportions. Likewise, *variegatus* seems to be more closely related to other species of *Peropus* than to any *Gehyra* (*s. s.*) species, not only in division of lamellae but also in the size of body, size of digital pads, size of scales on the head, and head proportions. The species of *Gehyra* have evolved primarily in the direction of Polynesia, in turn invaded by only waif populations of *Peropus;* the species of *Peropus* have evolved primarily in the direction of Indochina. One line (*Gehyra*) developed a larger size, larger broad pads with entire lamellae, and a slender head; the other line (*Peropus*) remained small and developed narrow pads with divided lamellae, and a broader head. Australia or New Guinea is obviously the focal point of these two evolutionary lines, and obviously *australis* and *variegatus* represent their closest living morphological links. In view, however, of (1) the distinct morphological and geographic niches the two species groups occupy, (2) the magnitude of the digital character wherein they differ, relative to other characters differentiating geckos, (3) the absence of intermediacy in that character, and (4) the respectable number of species in each

group (3 and 10), taxonomic admission of both genera seems to us to portray the situation most accurately and to fit most harmoniously with the currently accepted concept of the philosophical and practical role of the genus.

The synonymies of the two genera *Peropus* and *Gehyra* thus stand as follows.

Gehyra Gray

Gehyra Gray, 1834, Proc. Zool. Soc. London: 100, type by monotypy *Gehyra pacifica* Gray, *loc. cit.* = *Gecko oceanica* Lesson, 1830.

Phyria Gray, 1842, Zool. Misc.: 53, type by monotypy *Phyria punctulata* Gray, *loc. cit.* = ?*Gehyra australis* Gray, 1845.

Perodactylus Fitzinger, 1843, Syst. Rept.: 19, 103, type by original designation *Hemidactylus oualensis* Duméril and Bibron, 1836 = *Gecko oceanicus* Lesson, 1830.

Range.—The Moluccas eastward through New Guinea, Norfolk Island and Polynesia; northern Australia.

Referred species.—Three: *Gehyra australis* Gray, 1845 (syn.: *Gecko grayi* Steindachner, 1867; ?*Phyria punctulata* Gray, 1845); *Gehyra marginata* Boulenger, 1887 (syn.: *Gehyra fischeri* Strauch, 1887; *Gehyra marginata* Boettger, 1895); *Gehyra oceanica* (Lesson, 1830) (syn.: *Gehyra gularis* Gray, 1842; *Hemidactylus oualensis* Duméril and Bibron, 1836; *Gehyra vorax* Girard, 1847).

Peropus Wiegmann

Peropus Wiegmann, 1835, Nova Acta Acad. Leop. — Carol., 17:238, type by monotypy *Hemidactylus* (*Peropus*) *mutilatus* Wiegmann, *loc. cit.*

Dactyloperus Fitzinger, 1843, Syst. Rept.: 19, 103, type by original designation *Hemidactylus variegatus* Duméril and Bibron, 1836.

Peripia Gray, 1845, Cat. Liz. Brit. Mus.: 158, type by subsequent designation in Smith, 1935, Fauna Brit. India, Rept. Amph., 2:104, *Hemidactylus peroni* Duméril and Bibron, 1836 = *Hemidactylus* (*Peropus*) *mutilatus* Wiegmann, 1835.

The names *Chalinocnemis* and *Spasmocnemis* Dugés, cited by Smith (1935, *op. cit.*: 104) and Smith and Taylor (1950, Bull. U. S. Nat. Mus., 199:51) as synonyms of this genus are not available and, therefore, have no nomenclatural status whatever under the Code of Nomenclature of London, 1959.

Range.—Southern Asia from Ceylon to the Philippines, south through the Indian Ocean islands and Madagascar, the Seychelles, and the Malay Archipelago to Australia and New Zealand, thence eastward through the Hawaiian and south Pacific islands; western Mexico.

Referred species.—Ten: *Peropus baliolus* (Duméril 1851); *Peropus barea* (Kopstein 1926); *Peropus brevipalmatus* (Peters 1874); *Peropus butleri* (Boulenger 1900); *Peropus intermedius* (Brown 1902); *Peropus interstitialis* (Oudemans 1894); *Peropus leopoldi* (Brongersma 1930); *Peropus mutilatus* (Wiegmann 1835) (syn.: *Gehyra beebei* Annandale 1913; *Peripia brevicaudis* Macleay 1878; *Gecko harrieti* Tytler 1864; *Dactyloperus insulensis* Girard 1856; *Hemidactylus navarri* Dugès 1883; *Peropus packardi* Cope 1868; *Peripia papuensis* Macleay 1878; *Gecko pardus* Tytler 1864; *Hemidactylus peroni* Duméril and Bibron 1836; *Hemidactylus platurus* Bleeker 1858); *Peropus papuanus* (Meyer 1874) (syn.: *Gehyra lampei* Andersson 1914; *Peripia marmorata* Macleay 1878); *Peropus variegatus* (Duméril and Bibron 1836) (syn.: *Peripia longicaudis* Macleay 1878; *Peropus variegatus punctatus* Fry 1914). We regard as unidentifiable the two remaining nominal species, *Peripia dubia* and *P. ornata* Macleay, 1878.

Discussion.—Members of the genus have been accidentally introduced into the Hawaiian Islands (Oliver and Shaw, 1953, Zoologica, 38:70), New Zealand (McCann, 1955, *op. cit.*: 17), and Mexico (Smith and Taylor, 1950, *op. cit.*: 40). *Peropus mutilatus* (Wiegmann), recorded from the states of Jalisco, Nayarit and Sinaloa in Mexico, "arrived on the west coast of Mexico probably from the Philippines" according to Smith and Taylor (*loc. cit.*).

To return to the six species of *Peripia* (=*Peropus*) described by Macleay in 1878 from specimens secured in New Guinea, it is difficult to understand why de Rooij (1915), in her excellent treatment of the reptiles of the Indo-Australian Archipelago (which includes all of New Guinea), neglected to mention these species. De Rooij was certainly aware of Macleay's paper because she cited several geckos of other genera described by Macleay. Following Boulenger's (1885) tentative assignment of Macleay's six species to *Gehyra* with no comment, no further mention of them has appeared in the literature to our knowledge.

A careful comparison was made of the brief published description of each of Macleay's species with the fine published description of the seven species of *Gehyra* recorded by de Rooij (*op. cit.*) from New Guinea and the recently described *G. leopoldi* Brongersma, 1930 from New Guinea. It is apparent that most of the species described by Macleay can be referred with little hesitation to the synonymy of species of *Peropus* known from New Guinea and described prior to 1878.

The characters ascribed to *Peripia papuensis* from Katow, New Guinea, and *Peripia brevicaudis* from Darnley Island fall well within the range of variation exhibited by *P. mutilatus* (Wiegmann 1835), and both of these names may be assigned to the synonymy of the latter species. *Peripia longicaudis* from Endeavour River may be referred to the synonymy of *P. variegatus* (Duméril and Bibron 1836) and *Peripia marmorata* from Katow is probably *P. papuanus* A. B. Meyer, 1874.

The descriptions of *Peripia dubia* from Cape Grenville and *Peripia ornata* from Port Moresby are so brief and inadequate that it is difficult properly to assign these two names to any of the known eight species of *Peropus* recorded from New Guinea.

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A New Subspecies of *Conopsis nasus* from Chihuahua, Mexico

WILMER W. TANNER

The genus *Conopsis* Günther, as redefined by Taylor and Smith (1942:329), occurs from Chihuahua on the north to the states of San Luis Potosi, Mexico, Morelos and Michoacán on the southeast and south. The species *C. biserialis* Taylor and Smith inhabits the southern half of the states of Mexico and Michoacán and in Distrito Federal and Morelos. The species *C. nasus* Günther inhabits a larger area to the north.

In the original description of *Conopsis nasus*, Günther (1858:6) lists California as the type locality. According to Taylor and Smith (1942:326) this is in error. The absence of other records, even near California would seem to confirm this conclusion. The origin of the type specimen is unknown; however, it is logical to assume that the type came from the western part of the range in Michoacán or Jalisco, and was taken either by Mr. Bridges, or by an acquaintance who gave it to him, as he traveled to or from California. Furthermore, specimens seen from Michoacán and Jalisco correspond more nearly to the type description than do most specimens seen or described from populations in other areas. For example the loreal is more often absent, there are usually small spots in the dorsal series, usually darker anteriorly, and the ventral and caudal counts reach the limits (which are extreme in the type) found in the type.

Jan (1862:59-63) erected the genus *Oxyrhina* and placed in it the following subgenera and species: *Oxyrhina varians, O.(Achirhina) defilippi, O.(Exorhina) maculata* and *O.(Ephirhina) tessellata*. Both *varians* and *defilippi* have been placed (as they should be) in the genus *Toluca*. Although the latter two names were listed by Jan (1857) in his list of species in the Museo Civico di Milano, they were not properly described by Jan (1862) until after Kennicott (1859) had described the genus *Toluca*, with *T. lineata* as the genotype. Günther (1885-1902) and Taylor and Smith (1942:332) both considered *Oxyrhina (Achirhina) defilippi* Jan a synonym of *Toluca lineata lineata* Kennicott. Günther includes *Oxyrhina varians* Jan in the synonymy of *Conopsis nasus*, whereas Taylor and Smith consider it a subspecies of *Toluca lineata*.

Jan (1862:61) was aware of the description of *Toluca lineata* Kennicott; he cited the reference (*Toluca lineata* Kenn. U. S. and Mex. Boundary Survey, 1859, II, part 2, Reptiles p. 23.) and recognized both subspecies of *Toluca* (*lineata lineata* and *lineata varians* - his *O. defilippi* and *O. varians* respectively). He made, however, no reference to *Conopsis nasus* Günther. We may speculate that Jan considered *C. nasus* to be far removed (California) from

the area under consideration or that the large spotted form (*maculata*) seen by him was distinct.

Concerning the description of *Oxyrhina* (*Epirhina*) *tessellata* Jan (1862:62) there is reason to suspect that the single type specimen was actually an aberrant representative of his series of *O. maculata*. Four characters are emphasized in the description: the reduced supralabial series (6), absence of loreal, one or two scales between the posterior chinshields, and a checkered (*tessellata*) abdominal pattern. These characters do occur in various combinations throughout the populations of *Conopsis nasus nasus*, but are rarely found in a single individual. Except for the tessellated abdominal pattern the type does not differ in color pattern from *maculata*, nor are there additional variations indicated in the basic scale patterns.

There was presumably doubt in the mind of Jan (1862:62) as to the relationship and distinctness of *tessellata*. He stated ". . . since they [*maculata* and *tessellata*] are identical in the proportion of body and form of head the differences may be considered as coming from an anomolous individual. . . . the same supposition may exist even in considering the frontals and parietals as a part of the [same] aberration."

The final statements of his description is also of a conditional nature. "The regular distribution of the black quadrate spots on the abdomen suggest to me a *tessellata* quality, which, serves to distinguish it as a variety of *maculata*, and until the observation of other specimens, may or may not justify its separation as a distinct species."

Although one has no way of actually determining the type localities, an examination of the descriptions and available specimens seem to suggest that the type specimen of *C. nasus* Günther is a representative of a southwestern population, whereas the series seen by Jan (*Oxyrhina maculata* including *O. tessellata*) originated in the central or southeastern part of the range. Furthermore the material seen for this study provides the same conclusion as that reached by Taylor and Smith (1942:329-32), that the variation of the color and scale patterns is so widespread throughout the species as not to justify the separation of *maculata* as a subspecies.

Among the southern populations are individuals with the checkered ventral pattern, strongly suggesting that *O.* (*Epirhina*) *tessellata* Jan is a color variant of *O. maculata* Jan. The absence of a loreal and the reduction of the supralabials to six, while not common, does occur throughout the entire range of *Conopsis nasus*. One is, therefore, forced to conclude that the type of *tessellata* was an aberrant specimen of the series and that *tessellata* is a synonym of *maculata*.

Since 1930 herpetological activity in Mexico has extended the range of *Conopsis* and increased the material available for study.

In 1940 Taylor and Knobloch reported the first specimen of *Conopsis nasus* for Chihuahua. Two years later Taylor and Smith (1942) listed a specimen for Mojárachic, Chihuahua. Although the first report does not give the specific locality it is presumed that the same specimen is referred to in both reports. Other records in their study suggest that *C. nasus* has a greater geographical range than was indicated by the earlier workers. In July 1958 and July 1959, W. Gerald Robison and I collected in the Sierra Madre Occidental of southwestern Chihuahua. Among the collections is a series of *Conopsis nasus* which exhibit characters distinct from those specimens seen from Durango and south into Michoacán. The Chihuahua population obviously represents a narrow northern extension of the range from the main body of the species to the south, and is a new subspecies to be known as

Conopsis nasus labialis subsp. nov.

Type.—Brigham Young University 16858, an adult male, from 25 miles southeast of Creel (27°20″ north longitude and 107° west latitude), Chihuahua, Mexico. Collected at 6500 feet on July 18, 1960 by Wilmer W. Tanner and W. Gerald Robison.

Paratypes.—BYU 16856-7, 16859-62, topotypes; 16952 22.5 miles southeast of Creel; 14295-8, two miles southeast of Creel; 16854-5, one mile west of La Laja (6 mi. E. of Mojárachic); and Chicago Natural History Museum 102846 (EHT 23018), Mojáhachic; Chihuahua, Mexico.

Diagnosis.—The new subspecies differs from *C. nasus nasus*, the only other subspecies, in usually having supralabials and infralabials 6-6 rather than 7-7, in having the second and third supralabials entering the orbit rather than the third and fourth, and with the fifth the largest of the series. Dorsal spotting variable as in *nasus*, but with ventral spots, when present, small, dark grayish, not black as in *nasus;* and tail without the distinct mid-ventral stripe.

Description of type.—Head not distinct from body, rostral broadly rounded, and protruding, only one pair of plates between rostral and frontal, other dorsal plates normal; nasal elongate, equal to length of first supralabial and higher anteriorly, nostril near middle; loreal present; one preocular and two postoculars; first temporal large, pentagonal and followed by two smaller scales; supralabials 6-6, second and third enter orbit; infralabials 6-6, first pair meeting on the mid-ventral line, fifth largest; first chinshields largest, second pair separated by a small median gular; four gulars between post-chinshields and first ventral; ventrals 128; caudals 35; dorsals 17-17-17; anal divided.

Dorsal ground color brown with a series of 49 dark brown median spots, each spot involving 4-8 scales; two distinct series of lateral spots, lower on first row of dorsals and edge of ventrals, these spots usually separated by three scales; second series on lower half of fourth row with spots separated by 2-4 scales. Ventrals ash gray with irregular widely scattered small dark gray spots, anterior becoming immaculate posteriorly; caudals immaculate.

Total length 300 mm., tail 52 mm., tail 17.3 per cent of total length.

Range.— Sierra Madre Occidental of southwestern Chihuahua.

Variation.—There is little variability in the scale patterns except

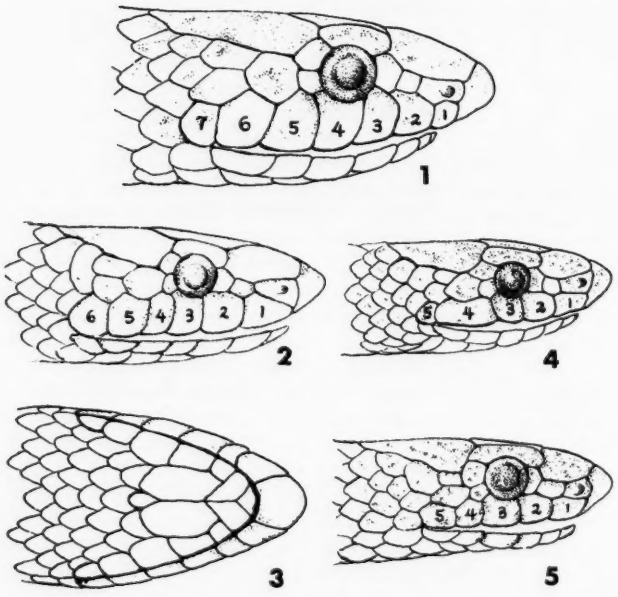

Fig. 1.—*Conopsis n. nasus* Günther lateral view showing seven labials, BYU 14284, 32.5 miles west of Durango City, Durango. × 3.5.

Figs. 2 and 3.—*Conopsis n. labialis* subsp. nov. lateral and ventral views showing six labials, BYU 16857, 25 miles south of Creel, Chihuahua. × 3.5.

Fig. 4.—*Conopsis n. labialis* subsp. nov. lateral view, showing five labials, BYU 14298, two miles southeast of Creel, Chihuahua. × 3.5.

Fig. 5.—*Conopsis n. labialis* subsp. nov. lateral view showing five labials, BYU 16860, 25 miles south of Creel Chihuahua. × 3.5.

for the supralabials. The dorsals are consistently 17-17-17; ventrals ♂ 122 to 132 (126.1), ♀ 127 to 132 (131); caudals ♂ 30 to 37 (34.3), ♀ 28 to 31 (29.6); supralabials 5-5=1, 5-6=2, 6-6=7, 6-7=2, 7-7=2, average 6.07; infralabials 5-6=1; 6-6=10, 6-7=1, 7-7=2, average 6.14; loreals 0-0=2, 0-1=2, 1-1=11, and with considerable variation in size and shape. Other scale patterns are normal for the species.

The first reduction in supralabials presumably occurs by a fusion of two of the first four plates (see Fig. 1); however, it is not clear as to which of these is most frequently involved, inasmuch as each is relatively larger, rather than one being noticeably largest. Figure 2 suggests, when compared with the normal condition in Figure 1 that the first three plates are now represented by plates one and two. In cases where only five scales occur the second reduction may be a fusion of the normal scales (considering 7-7 normal for

the species) five and six (Fig. 3). An exception to this, however, is indicated in Figure 5, with perhaps four and five being fused. In specimens with six supralabials, the fifth is largest, if only five supralabials, then the third or fourth is largest.

In total length the series varies from 109 to 301 millimeters with the tail averaging .142 in females and .171 in males, per cent of the total length.

The color pattern varies, not only in size and general shape of the dorsal and lateral spots but also ranges from a background of olive yellow, through a slate gray to a distinct brown. The dorsal spots may form a series of small spots, longer than wide and occurring on the mid-dorsal scale row and half of each adjoining row; or the spots may be expanded laterally to reach the first lateral row of spots, thus forming a series of larger transverse bars. Between these two extremes are other variations in size and shape (see Figs. 6, 7 and 8. Also see Taylor and Smith 1942:353-7). Most ventral plates are not spotted except for the small series of spots on the edge of the ventrals and the first row of dorsals. Other ventral spots are small, widely and irregularly scattered and of a dark gray rather than black color. The caudals are immaculate except which show a faint grey zig-zag stripe between the paired plates, and three with a series of fine line-like irregularly interrupted spots.

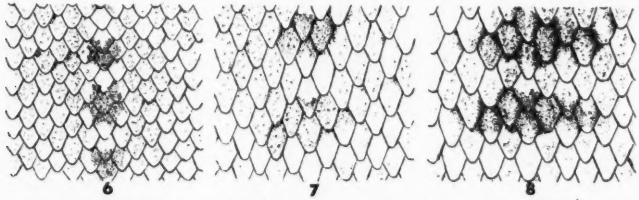

Fig. 6.—*Conopsis n. labialis* subsp. nov. dorsal view. BYU 14295 paratype.

Figs. 7 and 8.—*Conopsis n. nasus*. Dorsal views BYU 14286 and 14284, 32.5 miles west of Durango City, Durango. × 2.

Specimens Examined.—In addition to the type and 14 paratypes of *C. n. labialis*. I have examined a total of 34 *C. n. nasus* as follows: Five miles east El Salto (BYU 14469), 32.5 miles west Durango City (BYU 14284-6), Durango; Guanajuato (USNM) 10246, 110663-5), Guanajuato; 16 miles northeast Mazamitla (KU 29498), Jalisco (16 miles northeast is probably in Michoacán); four miles south Maravatio (KU 44999), 29.2 miles south Carapan (UI 23849-50), Nahuitzin (USNM 46426), Tacicuaro (USNM 110666-9), 10 miles east Morelia (USNM 110670), and seven specimens in the Edward H. Taylor Collection (17626-32), Michoacán; 37 miles east Concordia (UI 41587), Sinaloa (a new state record for Sinaloa); Plateado (USNM 46418), one-half mile southeast Zacatecas (UI 27152), Zacatecas; (USNM 11371, 31361, 31363-5, 25362) without specific locality data, and data sheets of Taylor and Smith.

Acknowledgements and Remarks.—Material examined for this study, although not as extensive as that seen by Taylor and Smith (1942) does cover approximately the same geographical area. Although most of the material seen was also available to Taylor and

Smith, new material from Durango, Jalisco, Michoacán, Sinaloa and Zacatecas is included.

An analysis of the data obtained from those specimens taken south of Chihuahua does not alter the general summary of variations presented by Taylor and Smith (1942:330-1) and therefore no summaries are presented here. Sufficient material is now available to indicate a clinal variation in the abdominal spotting. Chihuahua specimens range from immaculate venters to those with a few small widely scattered spots. Specimens from Durango do not have larger spots but many more small ones. In Guanajuato and Michoacán the spots are larger, some becoming large, quadrate shaped and occasionally arranged in a checkered (*tessellata*) pattern. A zig-zag dark mid-ventral caudal stripe is usually present in *C. n. nasus*. When present in *labialis* it is faint, or may be represented as a series of disconnected narrow lines. In the Durango specimens it is distinct but not as heavy as occurs in material from Guanajuato and Michoacán. The dorsal pattern is not seemingly consistent in any population.

These two subspecies are most consistently different in the per cent of supralabials, with only 24.7 per cent of the *nasus labialis* having a 7-7 pattern, whereas (Taylor and Smith, 1942) *nasus nasus* has, (for 350 counts) 90.3 per cent with 7-7 counts. By adding the four Durango specimens and six others taken since the study by Taylor and Smith (*loc. cit.*) there is 90.81 per cent of the specimens of *nasus nasus* with 7-7 supralabials. The largest series from one locality is the 125 specimens from Alvarez, San Luis Potosí. In this series 86.8 per cent of the specimens have seven supralabials.

I am indebted to the following fo: permitting me to study their specimens and for other courtesies: Hymen Marx, Chicago Natural History Museum (CNHM), H. M. Smith, University of Illinois (UI), J. M. Legler and E. R. Hall, University of Kansas (KU), and Doris M. Cochran, United States National Museum (USNM).

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A Review of the Geckoes of the *Sphaerodactylus scaber* Group of Cuba

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Since the description by Barbour and Ramsden of *Sphaerodactylus scaber* in 1919, two other species (*S. oliveri* and *S. storeyae*) of the same group of geckoes have been described by Grant (1944). All three belong to an assemblage of West Indian *Sphaerodactylus* which is typified by a middorsal granular zone, keeled and imbricating dorsal scales, smooth ventral and chest scales, and strong sexual dimorphism in coloration and pattern.

Sphaerodactylus storeyae was described by Grant on the basis of one specimen questionably from the Isla de Pinos; the type specimen is (*fide* Grant) an immature female, and thus gives little indication of the characteristics of the species. Through the auspices of a National Science Foundation grant, I have collected material referable to *storeyae* on the Isla and *oliveri* on the Cuban mainland. I have not seen *scaber* in life and thus feel somewhat handicapped in my assessment of this species; fortunately I have been able to examine some freshly taken material of *scaber*, as well as the type. For the loan of these lizards I am indebted to the following: Mr. Charles M. Bogert, American Museum of Natural History (AMNH); Dr. Ernest E. Williams, Museum of Comparative Zoology (MCZ); Dr. Carlos G. Aguayo and Dr. Isabel Pérez Farfante, Museo Poey (MP); Dr. George S. Myers and Miss Margaret Storey, Stanford University (SU); Dr. Norman E. Hartweg, Museum of Zoology, University of Michigan (UMMZ); and Dr. Doris M. Cochran, United States National Museum (USNM). The drawings are the work of Ronald F. Klinikowski, whose activities are sponsored by a National Science Foundation Undergraduate Research Participation grant.

There are two phylogenetic problems in these geckoes: first, whether the three named forms are distinguishable from one another and, if so, which characteristics will separate them and, second, what are their relationships with each other and with other gekkonids in the West Indies. It has long been my opinion that the multiplicity of named kinds of sphaerodactyls in the West Indies confuses a picture which can best be clarified by the use of trinomials. I do not feel that actual physical intergradation is essential in such an interpretation; obviously, when dealing with insular forms, such physical intergradation is impossible. Even on some large islands such as Cuba, where several members of the same group of geckoes may occur (*i.e.*, *S. decoratus; S. scaber* and its relatives), the relationships between named forms may be much better expressed by trinomials, even if no strict intergrades

have been found. Examination of pertinent materials often indicates that two or more forms are related; similar scalation, similar coloration, pattern, and dimorphism, similar shape of the escutcheon all may reveal close relationships when intergrades themselves are absent or as yet uncollected.

In addition to the three Cuban forms, I consider the Bahaman *S. anthracinus* Cope and the Hispaniolan *S. copei* Steindachner as being members of this same complex. I do not include *S. sputator, S. vincenti, S. fantasticus,* or *S. elegantulus* in the present assemblage because in these forms occur such various characteristics as keeled chest scales and ventrals, short snouts and long tail, weak sexual dimorphism, and lack of a middorsal zone of granules despite decreased size of the middorsal scales. The inclusion of Cuban, Hispaniolan, and Bahaman forms together is logical geographically; of the West Indies, these islands are in proximity to one another, and, in addition, their reptilian faunas have been shown previously to have certain elements in common.

Mention also should be made of *Sphaerodactylus becki* Schmidt as a member of this same complex of species. I have examined the type, and, insofar as I know, the only extant specimen of this Navassan form. The type (AMNH 12595) is small and lacks an escutcheon; Barbour (1921:265) considered it a half-grown male. The dorsum is completely patternless and is now a uniform tan. There is a light canthal line which continues posteriorly behind the eyes and joins its mate on the occiput to form a poorly defined U-shaped figure. In addition, this U encloses a very faint, pale transverse bar on the dorsal surface of the head. As seen below, this general type of head pattern is allied to that of *copei* and *anthracinus*. Lack of sufficient material prevents an analysis of the relationships of *becki,* since sexual differences and ontogenetic changes obviously cannot be determined. I suspect that *becki* is an isolated relative of the Hispaniolan *copei,* but more specimens of the Navassan species are required before its relationships can be clarified.

Of the five forms now under consideration, *anthracinus* and *copei* are large for sphaerodactyls, whereas the three Cuban forms are smaller and of moderate size; none reaches the large size of *anthracinus* and *copei.* Of the two forms, I have examined five male, six female, and three juvenile *copei,* and five male, 12 female, and three juvenile *anthracinus.* Both are distinctly dimorphic; males are in general uniformly brown dorsally, and male *copei* have some remnants of the female head pattern (see below). Male *anthracinus* may develop a strongly vermiculate head pattern; two males (AMNH 80112, UMMZ 117389) from New Providence show this condition, along with a very dark throat vermiculation, whereas other New Providence males do not have a distinctive

head pattern. I assume this to mean that male *anthracinus* may develop the dark head with increasing age; this may not necessarily be true since the two distinctively marked males fall within the range in snout-vent length of males which are unicolor.

Young females and juveniles of *anthracinus* and *copei* are typified by the presence of a dark brown to blackish collar with four pale ocelli (figures 1 and 2). In *copei* this collar persists even into large females, but not in *anthracinus*. In young *anthracinus* there is one major dark stripe between the limbs, with a less well-defined one anterior to it. In *copei* there are two dark stripes between the limbs (each stripe made up of a pair of dark bands and an included lighter area). The single stripe in *anthracinus* does not persist as such, but with increasing size it blends in with the general salt-and-pepper coloration of the adult female. The two dark stripes in *copei* disappear in adult females, and this form too has a salt-and-pepper pattern.

The head pattern of *copei* consists of a pale occipital spot, a pale canthal stripe which continues posteriorly behind the eyes to form at times a complete pale U behind and surrounding the pale occipital spot, and a median unpaired pale stripe on the head, beginning between the eyes and extending posteriorly onto the occipital region. The heads of *anthracinus* are much like those of *copei* except that the pale occipital spot is less pronounced, the occipital U is absent, and the entire occipital region is spotted or marked with whitish.

The escutcheons of the two forms are comparable (figures 6 and 7); both have branches which extend onto the thighs, these branches two to three scales wide in *anthracinus* and two to four scales wide in *copei*. The broad central portion of the escutcheon has six or seven scales in its greatest length in *anthracinus* and five to eight scales in *copei*. The dorsal zone of small granules is two or three scales in width in *anthracinus* and one to three scales in width in *copei*, and there are nine or ten rows of keeled lateral scales in *copei*, and eleven or twelve in *anthracinus*. In both forms the rostral is medially creased, with three postrostrals, the outer two the larger.

The Cuban *oliveri* and the Isla de Pinos *storeyae* share certain characteristics. I have examined one male, nine females, and four juveniles of *oliveri*, and four males and two females of *storeyae*. The *storeyae* males are unicolor gray dorsally with pale yellow heads in life, with faint, tan, head-pattern remnants, whereas the male *oliveri* is salt-and-pepper patterned with a faintly lined head. The dorsal pattern of female *storeyae* is composed of weakly defined crossbands, on a dull yellowish-tan dorsum in life; since there are no fresh juvenile *storeyae*, modifications of the female pattern are unknown. However, Grant's (1944:125) description of

the juvenile female type of *storeyae* states: "a dark stripe from snout to eye, branching behind eye into three; six dark cross stripes from nape to sacrum inclosing lighter broken stripes; all lines uneven and not clear-cut." It is apparent that the six dark cross stripes (bands) become more diffuse with age. In the adult females the head (figure 3) has four distinct longitudinal stripes, one canthal stripe on each side, which proceeds behind the eye across the temporals, and a pair of dark stripes between the eyes, each of which extends onto the occiput, and is followed by distinct dark blotches of equal width to the interocular stripes and appears to be a fragment of them. There is a pair of dark brown shoulder blotches, each including an ocellus.

Female *oliveri* resemble female *storeyae*. The single female seen in life had a yellowish tan dorsum. The juveniles of *oliveri* have the head pattern (figure 4) as described for *storeyae* females (but lack the pair of dark dots behind the interocular stripes), as well as two black blotches with ocelli, and a series of six dark transverse bands which were probably organized into three pairs in life; however, two juveniles are speckled dorsally, and one is uniformly tan. The females have two patterns: 1) head pattern as described for *storeyae* but lacking the posterior dark dots, a pair of black blotches with light ocelli (one of which, in the living *oliveri*, was only unilaterally orange) on the shoulders, and a distinct narrow black collar; 2) a typical salt-and-pepper pattern instead of cross bands. I assume that the latter is the fully adult female pattern.

The escutcheons of the two forms are much alike, each with a narrow extension onto the thighs, this extension being two scales in width. The central portion of the escutcheon is not greatly expanded as in *copei* and *anthracinus* and has three or four scales longitudinally in *oliveri* and five to six scales in *storeyae*. Both forms have a creased rostral with three postrostrals, the outer two the larger. The dorsal zones in both forms are two to three granules in width, and *storeyae* has eight to ten lateral rows of keeled scales, whereas *oliveri* has nine to eleven lateral rows.

The remaining member of this complex is *S. scaber*. I have examined seven male, six female, and four juvenile *scaber*. The males show three patterns, which I assume to be ontogenetic. Three males are pale dorsally, but show faint remnants of the juvenile pattern of cross bands; a pale postauricular band, a pale shoulder band, and at least two dark body bands between the limbs. The head pattern, described below, is faint but discernible in these males. Two males are uniformly pale dorsally, with no body pattern whatsoever, but do show the head pattern. The remaining two males have a salt-and-pepper dorsum with the dark scales scattered and discrete.

The juveniles resemble the first group of males described above,

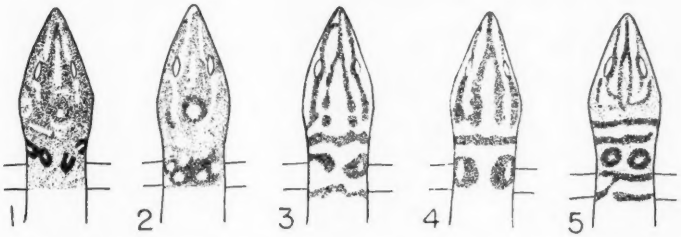

Fig. 1.—*Sphaerodactylus anthracinus,* UMMZ 113789 (field number VV-AMNH 2705), female, dorsal view of head.
Fig. 2.—*Sphaerodactylus copei,* USNM 117289, female, dorsal view of head.
Fig. 3.—*Sphaerodactylus storeyae,* AMNH 81192, female, dorsal view of head.
Fig. 4.—*Sphaerodactylus oliveri,* AMNH 78350, female, dorsal view of head.
Fig. 5.—*Sphaerodactylus scaber,* MCZ 57354, female, dorsal view of head.

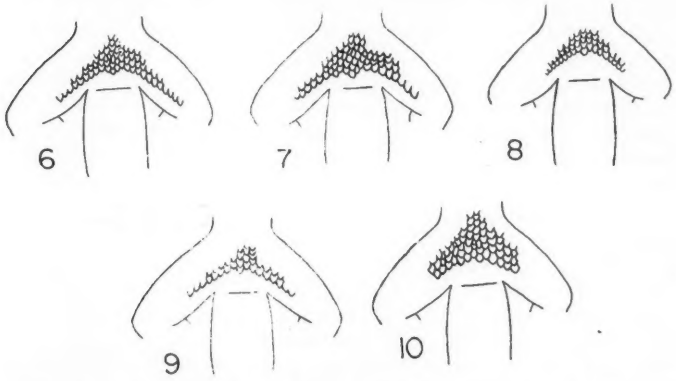

Fig. 6.—*Sphaerodactylus anthracinus,* UMMZ 113789 (field number VV-AMNH 2701), escutcheon of male.
Fig. 7.—*Sphaerodactylus copei,* USNM 117290, escutcheon of male.
Fig. 8.—*Sphaerodactylus storeyae,* AMNH 81196, escutcheon of male.
Fig. 9.—*Sphaerodactylus oliveri,* MCZ 19568, escutcheon of male.
Fig. 10.—*Sphaerodactylus scaber,* UMMZ 90630, escutcheon of male.

but have three dark body bands. The females show the progressive pattern change from the three-banded juvenile pattern, through a gradual dissolution of this pattern by a lightening of the centers of the bands, the development of ocelli or at least a distinct light center in the dark neck band or collar (this band remaining as such and not breaking up into paired dark blotches as in *storeyae*), to a darkly salt-and-pepper adult pattern.

The head pattern of *scaber* is distinctive (figure 5). The ground

color of the head is brownish, and there is a pale, not dark, canthal line, a pale median stripe from the eyes to the occiput, a pale J-shaped or I-shaped postocular stripe onto the occiput, and a definite pale stripe from the eye onto the throat below the tympanic opening. This pattern may become increasingly obscure with age, but is never completely obliterated.

The escutcheon is very long centrally, with from seven to nine scales in its greatest longitudinal extent, and it usually sends thin bars, one scale in width, onto the thighs, although these may be absent entirely (figure 10). The rostral is creased medially, with three postrostrals, the outer two the larger. The dorsal zone has one or two rows of small smooth granules, and there are nine or ten lateral rows of keeled scales.

From the foregoing discussion of the characteristics of the various populations involved, certain patterns of relationship and distribution can be interpreted. I feel that *copei* and *anthracinus* are related more closely to one another than to the Cuban forms and share such features as these: the large size, uniformly brown males without salt-and-pepper patterns (although *anthracinus* males may additionally develop a dark vermiculate head pattern, a condition unknown in *copei*), comparable female head patterns, dark collar with four ocelli, comparable escutcheons with central portion of escutcheon relatively broad (five to eight scales) and broad thigh extensions. Despite these similarities the two forms are certainly distinct.

Sphaerodactylus scaber appears to be an isolated member of the *anthracinus-copei* pair. It differs from these two forms (and from *storeyae* and *oliveri* as well) in its distinctive pale, rather than dark, head pattern, and a larger escutcheon which has seven to nine scales centrally and narrow thigh branches. Like *anthracinus* and *copei*, *scaber* has a dark collar with four ocelli, and adult females of all three have a salt-and-pepper pattern. *S. scaber* has three dark bands in the juvenile, *copei* has two, and *anthracinus* has two, of which the more anterior one is obsolescent. Adult male *scaber* are salt-and-pepper, whereas males of *anthracinus* and *copei* are unicolor gray.

The forms *storeyae* and *oliveri* are close to each other. The head patterns are almost identical, with the exception of the dark dots at the posterior ends of the interocular stripes. Both have dark shoulder blotches with ocelli. The escutcheons are narrow centrally, with from three to six scales at the widest point. The dorsal zones have the same number of granules transversely, and the two forms have from eight to eleven rows of keeled laterals. On the other hand, the adult pattern of male *oliveri* is salt-and-pepper, that of male *storeyae* is unicolor. If we assume that the unicolor condition precedes the salt-and-pepper pattern, this ap-

parent difference between the two forms may be due to an inadequate series of males of both forms. The same is true of the female pattern differences: salt-and-pepper in adult female *oliveri* and diffusely cross-banded (on the way to salt-and-pepper?) in *storeyae*.

It is obvious that *storeyae* and *oliveri* are closely related to one another; the relationships between *anthracinus*, *copei*, and *scaber* are not so clear. I feel that these relationships are best expressed in the use of trinomials for the first two forms, and thus the names of the central Cuban and Isla de Pinos forms should be *Sphaerodactylus oliveri oliveri* Grant, and *Sphaerodactylus oliveri storeyae* Grant. Since the provenance of the type of *storeyae* is unknown and only questionably from the Isla de Pinos (Grant, 1944:125), it seems appropriate to affirm this locality and to restrict the type locality to Punta del Este, Isla de Pinos, Habana Province, Cuba, a locality where *storeyae* is now known to occur.

The remaining three forms are confusing in their relationships. I am tempted to regard all three as races of *S. anthracinus* Cope. I am deterred from this move especially because of the very distinctive head pattern of *scaber*. I regard, however, the differences between *copei* and *anthracinus* as being on a racial level and consequently suggest the use of the names *Sphaerodactylus anthracinus anthracinus* Cope and *Sphaerodactylus anthracinus copei* Steindachner, and I would retain the binomial *Sphaerodactylus scaber* Barbour and Ramsden for the eastern Cuban form. I realize that this arrangement interposes a related, but different, species more or less between the ranges of the races of *anthracinus*. However, as pointed out previously, I feel that *scaber* (and probably *becki* as well) is an isolated derivative of *S. anthracinus*.

Specimens examined.—*S. scaber*: Cuba, *Camagüey*, Sierra de San Juan de los Perros, 4 (MCZ 12304, 13440; UMMZ 90630 (2)); Sierra de Jatibonico, 1 (MCZ 7952); Finca La Concepción, near Jicotea, 6 (MCZ 57353-58); Sierra de Najasa, 3 (MP 47); *Las Villas*, Finca San Lorenzo, Sitiecito, Sagua, 2 (MP 193); Finca Tamarindo, Calabazar de Sagua, 1 (MP 187).

S. oliveri oliveri: Cuba, *Las Villas*, Farallones de Guajimico, 1 (MP); near Cienfuegos, 1 (MCZ 52210); Soledad, 3 (MCZ 22717; UMMZ 93310-11); mountains near Soledad, 1 (MCZ 19901); Trinidad, 4 (MCZ 19568; USNM 138018-20); Finca Morales, 8 mi. NW Trinidad, 1 (AMNH 78350); Rancho Gavilan, 3 (SU 14684-86).

S. oliveri storeyae: Isla de Pinos, Habana, Punta del Este, 6 (AMNH 81191-96).

S. anthracinus anthracinus: B. W. I. *Bahamas*, Andros Island, 2 (MCZ 6222); New Providence, Nassau, 18 (AMNH 80112-18; UMMZ 117389 (8); UMMZ 118026 (3).

S. anthracinus copei: *Haiti*, Diquini, 14 (USNM 117289-99, 121046-47, 121507).

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Remarks On a Collection of Bolson Tortoises, *Gopherus flavomarginatus*.

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In 1959, Legler described and named a new species of tortoise (*Gopherus flavomarginatus*) from extreme northeastern Durango and adjacent parts of Coahuila and Chihuahua, México. The small amount of material upon which the description was based (three stuffed specimens and three carapaces) left much to be desired in regard to knowledge of variation within the species. In the last two years, the authors have independently obtained a total of nine additional specimens of *G. flavomarginatus*, all of which were examined in detail and photographed while alive. The results of our observations, summarized below, contribute generally to a knowledge of this tortoise.

The series available for study consists of the following (asterisk indicates a now-living specimen): Michigan State University Museum (MSU) 2251 and University of Kansas Museum of Natural History (KU) 53806, 20 km. east of Ceballos, Durango, August, 1959, R. G. Webb and J. K. Greer; University of Utah Museum of Zoology (UU) 3572-3, 2R*, A. D. MacEwen private collection, Salt Lake City (ADM) 9*, 10*, 12*, and Philadelphia Zoological Garden (PZG) one specimen*, eight km. east of Ceballos, Durango, September, 1960, J. M. Legler and M. R. Lee. Measurements and sexes of these specimens are given in Table 1.

Our specimens and much of our data were obtained from natives in and near the town of Ceballos. We attempted to corroborate verbal accounts, whenever possible, by querying more than one person on each point that seemed to be of importance.

Distribution and Habitat.—On the basis of known specimens, the geographic range of *G. flavomarginatus* is approximately 75 miles in greatest diameter (southwest to northeast). The species seems to be restricted to local areas of sandy or salty soil. It is significant that all specimens having more or less definite locality

data come from the vicinity of old lake beds (Americanos, Coahuila; Carrillo, Chihuahua; and Ceballos, Durango). Natives told us that the species occurs on the east side of the Sierra de Banderas (just east of Conejos, Durango), and there are vague reports that it occurs near Mapimí. Persons in Ceballos allowed that tortoises (locally called *tortuga llanera*) were found both east and west of that town but that they were more common to the east.

The type locality of *G. flavomarginatus* was stated (Legler, 1959:337) as ". . . 30 to 40 miles from Lerdo, Durango . . .". Habitats in the immediate vicinity of Lerdo, Gomez Palacio, and Torreón seem to be unsuitable, and the species probably has been extirpated there by hunting and by the encroachment of urban and agrarian development. Therefore, the somewhat indefinite type locality might logically be amended to read "30 to 40 miles north of Lerdo," where suitable habitat exists. The general area referred to would be near La Campana (World Aeronautical Chart, 521, Lake Santiaguillo, 1957) and just south of a mountain range bearing the same name. The locality "Lerdo" for one paratype (USNM 60976) could be interpreted in the same manner.

The consensus among the older men we talked to in Ceballos was that tortoises had become perceptibly rarer in that area in the last three decades. Aware of this fact, a local shopkeeper expressed delight that our specimens would be used for scientific study; he said that he no longer sold tortoises because he anticipated their extinction.

Habits and Reproduction.—Gopherus flavomarginatus digs burrows. According to natives, these burrows are found most often on sandy flats near the bases of hills. Burrows of tortoises are distinguished from those of other animals in being flat on the bottom and rounded on top, rather than circular. The flesh of these tortoises is prized as food by persons in rural areas. The tortoises are captured by excavating a burrow. It takes one man about a day to dig out a tortoise. Some men near Conejos said they were able to drag tortoises from burrows with a long hooked or curved stick. Webb was told that the reflected image from a mirror, placed in front of a burrow, caused the tortoise to "come out and fight."

Captive tortoises kept by us for several weeks ate greens, apples, and pears readily and defecated hard dry pellets one to one and a half inches in diameter. When placed outside on a sunny lawn, they ate grass in preference to apples and pears that were abundant on the ground. After eating steadily for a half an hour to an hour, they would begin to move rapidly about the yard. Tortoises were never observed to drink, even when placed for long periods in a pan of shallow water. The bladders of two dissected specimens each contained slightly more than a quart of greenish liquid in which there were pasty, gray urinary solids.

When seven tortoises (three males and four females) were placed in a smaller (15 feet square) grassy enclosure, one male (UU 3573) became immediately active and, at different times, chased each female about the enclosure. In following a female, he would attempt to overtake her and circle in front of her, crowding her against the fence or some other obstacle whenever possible. When this maneuver was successful, the male ended up facing the female, who retracted her head and legs. The male bobbed his head when he was stationary or moving slowly. The head-bobbing occurred irregularly in nearly all phases of courtship. When the male was able to crowd a female into the fence and hold her motionless there by pressing his gular region against her side, he would pause a moment, back off an inch or so, and then ram her in a way that tilted her shell upward. In one instance the male, having chased a female into a corner, rammed her from behind in a way that carried his plastron onto the back of her carapace. Possibly this was an attempt to mount, but no successful mountings were observed. Of the other two males in the enclosure, one, a younger but equal-sized individual (ADM 9*), showed only mild interest in the females and rarely chased them; when not in the presence of other males, he became more aggressive. The smallest male (ADM 10*) remained inactive in a corner most of the time and was generally ignored by other tortoises. The two largest males occasionally chased and butted each other; we were not able to detect a significant difference between the behavior of males with males and males with females, except in frequency of contact.

In Durango, the young are said to be commonest in late summer and early spring. Eggs were described to us as being approximately the size and shape of a chicken egg. The eggs are also used by humans for food.

The ovaries of a mature female (UU 3572) bear eight enlarged, pale yellow follicles 14 to 16 millimeters in diameter and numerous whitish follicles less than five millimeters in diameter. Also on the ovaries there are 13 orange spheroid bodies, six to seven millimeters in diameter; each has a hollow center and lies beneath a small circular opening in the ovarian epithelium. The orange contents of these bodies is granular, about the consistency of coagulated yolk, and appears to be lipoidal. Probably these bodies are corpora lutea; if so, they differ markedly from the cuplike corpora lutea of emyid turtles (Legler, 1959: Pl. 20, fig. 2). The hollow centers, eroded epithelium, and uniform size of the spheres make us doubt that they are merely atretic follicles. There are also 27 small puckerings on the ovaries; the puckerings are dark-centered (purple when seen through translucent epithelium, dark orange when dissected) and have the same general appearance as the advanced

corpora lutea or corpora albicantia we have seen in emyid turtles. The puckerings vary somewhat in size, some lacking the orange lipoidal centers; they seem to be a stage in regression of the spheroid bodies mentioned above, but no other intermediate stages are evident. We conclude tentatively that the spheroid bodies and the puckerings are the sites of ovulations. Inasmuch as there are 40 of these ovulation points, we further conclude that they represent more than one set of ovulations and that possibly they occurred in more than one breeding season (thus differing from the corpora lutea of emyids which regress completely by the beginning of the next breeding season). The 13 corpora lutea are probably indicative of the size of the most recently laid clutch. The large follicles may be "extras" from the last breeding season (destined to become atretic) or may represent a future clutch, to be advanced to maturity in the following season. The weakness of these data (and our resulting conclusions) indicate the need for basic studies of reproductive cycles in *Gopherus* and in tortoises generally.

The testes of one specimen (UU 3573) are pale slate gray (immediately after death), elongate, and falciform; the inner curve is dorsal and lies against the curved ventral border of the kidney. The left testis is 75 × 15 millimeters when straightened. The testes of a large specimen of *G. agassizi* (UU 3571) are relatively shorter, more nearly oval, and only slightly indented dorsally. The penes of these two males (viewed before and after preservation) are alike except in color, that of *G. agassizi* being brownish gray whereas that of *G. flavomarginatus* is nearly white.

Coloration.—The colors of dried specimens in the type series do not differ significantly from those of live specimens of comparable size and age. The ground color of the plastron is yellowish, and that of the carapace ranges from darker shades of straw yellow to brown. The centers of the epidermal laminae are darkest, ranging from brown to black and, in most specimens, contrast sharply with the ground color, the contrast being sharper on the plastron and lateral marginal laminae than on the carapace. In most specimens there is a faint radial pattern on the carapace, most noticable on the centrals. This pattern appears as dark radiations on a pale ground in some specimens and as pale radiations on a dark ground in others, the difference being due to relative width of radiations and the relative amount of dark pigment in them. Soft parts range from dirty cream to yellow on areas where skin is granular. Larger scales (*e. g.*, on antebrachium and head) are pale yellow with darker centers (brown to black) of varying size.

All colors are brightest and most sharply contrasting in smaller, young individuals (smallest specimen, 164 mm. long). Quality and arrangement of color change with age and this change, according

to our observations, is due primarily to wear. The general trend of change is toward uniform pale brown. As the areolae are worn they become successively paler, those on the plastron finally approximating the ground color but those of the carapace remaining darker (usually brownish) than the ground color. The largest individuals (and apparently the oldest) have smoothly worn plastra that are uniformly pale, and carapaces that tend to be blotchy, having ragged (rather than distinct) darker blotches in the center of each scute. In the most severely worn specimens small, ragged paler areas occur within the dark ones. The patterns described above were observed through liquid; radiations and small blotches are not so evident on shells with dry surfaces.

The iris is dark neutral brown, flecked with gold or greenish yellow on its peripheral half; these flecks are finer, less numerous, and nearer the periphery in males than in females. The zone of the eyeball peripheral to the iris is yellow and is flecked with brown, the flecks more numerous and more heavily developed in males than in females. The nictitating membrane is pinkish gray.

Squamation.—In all 12 plastra of *G. flavomarginatus* examined the intergular seam is considerably longer than the interhumeral. This characteristic alone serves to distinguish *flavomarginatus* from other species, all of which have humeral at least somewhat longer than gular (93 per cent of *agassizi*, 79 per cent of *berlandieri*, and 100 per cent of *polyphemus*). Disparity in length of gular and humeral scutes finds its extremes in *agassizi* and *flavomarginatus;* length of gular, expressed as a percentage of humeral in these species is, respectively, 57 (range 44 to 78, 13 specimens) and 145 (range 116 to 164, 12 specimens). The gular-humeral sulcus crosses the anterior end of the entoplastron in *flavomarginatus*.

The remark of Legler (1959:339) that *G. flavomarginatus* has a ". . . single, rectangular axillary scale, wider below than above . . . " requires qualification in light of additional specimens examined. The axillary scute in all *Gopherus* is essentially four-sided but seldom is it actually rectangular. Of these sides the medial is invariably the longest and forms the anterior, inner, free edge of the bridge; the upper, lower, and lateral edges are variable in length and form seams with the third marginal, the pectoral, and the fourth marginal scutes, respectively. In *G. berlandieri* the lateral edge is shortest or non-existent, and the entire scute tends to be triangular or irregular in shape (57 per cent of *berlandieri* examined had two axillaries per side—the foregoing data pertain to the largest axillary). The scute is variable in *polyphemus* and *agassizi* but tends to have a short or curved lateral edge that slants sharply inward, increasing the angle between itself and the lower edge, and usually imparting a pointed, narrowed appearance to the lower end of the axillary. In *flavomarginatus* the axillary is about the

same width above and below (measured horizontally from outer angles) or slightly wider below, has a nearly straight outer edge, and has much less obtuse outer angles than do the other species. In one small male (ADM 10°) the axillaries are more like those of *agassizi* and *polyphemus* than *flavomarginatus*. Probably the shape of axillaries undergoes ontogenetic change.

The third central is ordinarily the widest of the central series in *G. flavomarginatus* (85 per cent of specimens) as it is in *G. berlandieri* (91 per cent); this characteristic distinguishes *flavomarginatus* from *agassizi*, which has the fifth central widest. In *polyphemus* the fifth or third central is broadest, each in about half the specimens examined (44 and 56 per cent, respectively).

All of the specimens of *flavomarginatus* have a pair of yellowish, elongated, black-tipped spines on the back of each thigh; the medial spine on each side is the smaller. The lateral spines of seven specimens were 10 to 20 mm. long (base to tip) and 6.5 to 13 mm. wide at base; length of spines is directly correlated with size. In most of these specimens the spines are at least as long as broad, and they are twice as long as broad in two large females. Nearly all specimens have other pointed osteodermal scales on the backs of the thighs and in one specimen (a small male) there is a third low spine on each thigh lateral to the largest spine. There is seemingly no sexual difference in size or configuration of femoral spines.

Smith and Brown (1946) described an integumentary gland ("subangular gland") of presumed hedonic function beneath each jaw angle in males of *G. berlandieri;* the glands were degenerate in females. Similar glands occur in both sexes of *G. flavomarginatus*, below and medial to the mandibular ramus about midway between symphysis and angle; the glands are oval (10 × 7 mm. in a female, 8 × 7 mm. in a male, approximately ½ greatest diameter of eye in both specimens). On each gland there are two ventral slitlike openings, each about one millimeter long (probably the ". . . very short ducts . . ." described by Smith and Brown). Smith and Brown (1946) were incorrect in their statement that subangular glands were unique to *G. berlandieri*. Agassiz, in the original description of *berlandieri* (1857:447), noted the presence of glands on the lower jaw and stated that they were more prominent than in other species. Grant (1936:226) first recorded the glands for males of *G. agassizi* and Carr (1952:330) has since observed them in *G. polyphemus*. The glands we observed in males of *G. agassizi* (no data on females) are relatively longer than those of *G. flavomarginatus* (equal to diameter of eye) and have a single ventral opening.

Scales on top of the head tend to be irregularly arranged, particularly the small ones anteriorly; ordinarily there are two prefrontals, one frontal, and two parietal scales (fig. 1).

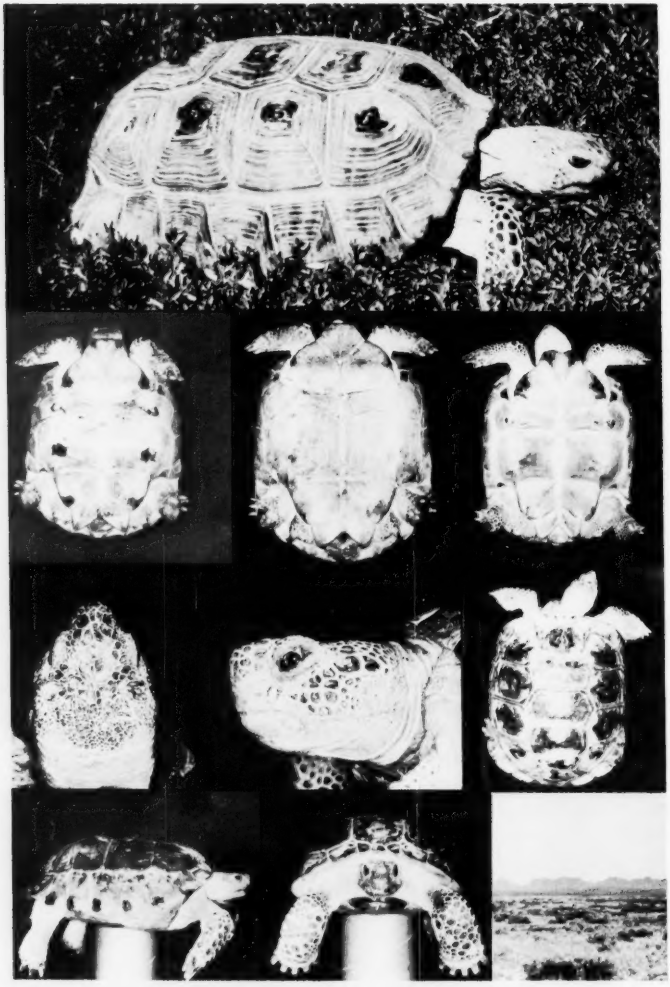

Fig. 1.—Living specimens of *Gopherus flavomarginatus* Legler: Top—KU 53806 ♀ × 1/6; Row 2—adult ♂ (ADM 9°) × 1/10, adult ♀ (ADM 12°) × 1/10, young ♂ (ADM 10°) × 1/8; Row 3—ADM 12° × 1/3, PZG° ♀ × 2/5, PZG° ♀ × 1/13 (showing worn carapace); Bottom—ADM 12° × 1/12, UU 3573 ♂ × 1/9, and habitat of *G. flavomarginatus*, looking east from 10 mi. NW Ceballos, Durango, 17 Sept. 1960. All photos are copies of color transparencies. Top photo by J. K. Greer.

Osteology.—No complete skeleton of *G. flavomarginatus* exists but a few osteological comparisons are possible on the basis of two specimens (UU 3572-3) which have been prepared as dry shells with preserved soft parts (leaving neck vertebrae, limb girdles, and proximal limb bones exposed for study). Peculiarities of two skulls have been noted elsewhere (Legler, 1959:337-338).

The precoracoid of *G. flavomarginatus* is relatively longer (measured from glenoid surface along mid-longitudinal axis) than in other species, being nearly as long or longer than the acromial process of the scapula (94 and 102 per cent). In other species the precoracoid is somewhat shorter than the acromial process—70 to 75 per cent of that element in *G. berlandieri* (2 specimens), 68 to 78 in *G. agassizi* (3), and 73 in *G. polyphemus* (1).

The centrum of the eighth cervical vertebra is seemingly unique in *G. flavomarginatus*. In both specimens the centrum is doubly concave cranially and doubly convex caudally. In UU 3572 the double convexity is asymetrical, the left condyle being about twice as large as the right. The same joint surface is symetrical in the other specimen. The latter skeleton was examined before and after maceration; in each of the cranial concavities of the eighth centrum there was a cartilagenous disc (flat in semidesiccated condition, biconvex in the living animal). The bony surface of the joint was concave but, with addition of the cartilagenous disc, was nearly flat and was probably at least slightly convex in life. This specimen was further unusual in having a seventh centrum doubly concave at both ends (*i. e.*, having its biconcave caudal surface opposed to the biconcave cranial surface of the eighth centrum). According to the vertebral formulae used by Williams (1950), the structure of the cervical centra in our two specimens can be expressed as: UU 3572—(2(,(3(,(4(,(5),)6},}7},}8}; and UU 3573—(2(,(3(,(4),)5),)6},}7{,}8}.

Doubling of a convex posterior joint on the eighth centrum is common only in family Carettochelidae. In this family, however, the eighth centrum is doubly biconvex. Williams (1950:528) stated that doubling of the cervicodorsal joint is known as an infrequent variant in the Testudinidae, and gave as examples (*op. cit.*:551) one specimen each of *Chrysemys picta, Pseudemys rubiventris,* and *Gopherus polyphemus.* In these specimens, however, the eighth centrum was biconvex, as is usual in testudinids and emyids. Of 352 specimens of testudinids recorded by Williams (*op. cit.*:522), none had the eighth centrum doubly concave anteriorly and doubly convex posteriorly; the condition was, however, recorded for two emyids (*Emydoidea blandingi* and *Pseudemys scripta*) both of which were abnormal in having nine (rather than eight) cervical vertebrae.

Size and Growth.—Adults of *G. flavomarginatus* are, on the average, larger than other members of the genus. In the total sample

examined by us, carapace length ranges from 164 to 371 mm., average 295. Nine of 15 specimens are longer than 300. Individuals of *G. agassizi* and *G. polyphemus* rarely get much longer than 300, and it is perhaps significant that the largest recorded specimens of these species (369 and 360, respectively) were long-time captives (Shaw, 1959:69 and Legler, 1959:342).

TABLE 1.—Measurements in millimeters of nine specimens of *Gopherus flavomarginatus* from the region of Ceballos, Durango. Width of carapace was measured at its midpoint. Height was measured, vertically, from center of plastron. All other measurements are maximal. See paragraph two for explanation of abbreviations.

	Sex	Length of Carapace	Width of Carapace	Length of Plastron	Height	Diameter of Hind Foot	Width of Head
KU 53806	♀	360	274	343	148	44	55
UU 2R*	♀	353	279	344	155	48	55
PZG*	♀	348	270	346	147	48	55
ADM 12*	♀	346	277	353	154	47	56
UU 3572	♀	326	259	330	138	43	52
UU 3573	♂	311	238	314	136	41	53
ADM 9*	♂	301	242	298	134	42	51
ADM 10*	♂	220	180	223	98	28	42
MSU 2251	♂	164	133	161	72	19	32

In most adults of *G. flavomarginatus* the shell is worn enough to prevent accurate examination or measurement of growth rings. One adult female (UU 3482, length 326 mm.) is unusual in having a slightly worn plastron. There are 19 zones of growth, including the actively growing (and most recently formed) zone and the zone formed in the season of hatching. Measurement of growth zones formed in the same year on different laminae indicated that the abdominal lamina comprised about the same percentage of total plastral length at all stages of growth (*i.e.*, 26 to 28). Applying methods of study that have been found useful for other kinds of chelonians (Legler, 1960:574-575), the following observations were made on this one specimen. Length of plastron (midline) was about 50 millimeters at hatching—slightly longer when measured from tips of gulars to tips of anals. Growth increment in the season of hatching (1942) was 15 per cent of original length and, growth increments in the second through sixth years, respectively, were 36, 21, 15, 10, and nine per cent. From the seventh through 19th years (1948 to 1960) increments varied from three to nine per cent, except in 1953 when an increment of 16 per cent was attained.

Human recollection of size of most reptiles tends to be faulty

and reports to us by natives, concerning the size of *G. flavomarginatus*, are here interpreted with extreme caution. All persons whom we queried in Durango agreed that the tortoises got much bigger than the ones we had in our possession (largest 360 mm.) and several men stated, independently, that a maximum length of nearly one meter was attained (see also Dugès, 1888:146-147). It is of interest that the large size of these tortoises makes them known to persons dwelling well outside the geographic range of the species; persons in Cd. Chihuahua and Ojinaga told Legler that large tortoises existed in the Bolson de Mapimí. Near Ceballos size is more often judged by weight than length. Estimates of maximum weight ranged from 35 to 50 kilos (approximately 77 to 100 pounds). We are inclined to doubt the authenticity of the reports on maximum weight and size. It seems certain, however, that *G. flavomarginatus* grows considerably larger than any known specimen, or did so within historic times.

The female dissected (UU 3482) is the second smallest (length of carapace 326 mm.) of seven known females and is sexually mature. It can be assumed that the larger females are likewise mature. The holotype of *G. flavomarginatus* (USNM 61253, 222 mm.) is a female but has secondary sexual characteristics less well developed than the other females; probably the holotype is immature or is a young adult. The two largest males (UU 3483, 311 mm.; and ADM 9°, 301 mm.) are known to be adults on the basis of dissection and behavior, respectively. A smaller male (ADM 10°, 220 mm.) is probably immature, as judged by its behavior with adult females, as is MSU 2251 (164 mm.). The remaining paratype (USNM 60976, 246 mm.) is clearly a male but, on the basis of size, is thought to be a young adult. These scant data suggest that sexual maturity is attained at carapace lengths of 220 to 300 mm. in both sexes (at about age 11 in one female, as reckoned by growth ring studies).

Sexual dimorphism.—The plastron of males is slightly more concave, in the abdominofemoral region, than that of females, but this difference can be detected satisfactorily only if several individuals of both sexes are examined together.

There is a subtle but consistent sexual difference in the tail. In females the tail is shorter and blunter and practically terminates at the anus, the part (if any) posterior to the anus consisting of a more or less evenly rounded projection. In males the part of the tail posterior to the anus is more tapered and has a distinct tip. In males the adpressed tail extends to or slightly beyond the posterior edge of the carapace and, when hanging downward (as in forward locomotion), touches or projects beyond the edges of the anal notch. In females the tail will usually not touch any of the free edges of the shell and will never extend beyond these free edges.

The posterior surface of the carapace descends (from anterior border of fifth central) farther and more steeply downward in females than in males.

According to the specimens we have examined, it seems that females of *G. flavomarginatus* grow larger, ultimately, than males; if this be fact, it would reverse the general trend for larger males in other species of *Gopherus*.

Remarks.—The only published reference to *G. flavomarginatus* since the type description is seemingly that of Grant (1960). Grant doubted the validity of locality data for the USNM type specimens and the validity of the species *flavomarginatus*. He suggested that the USNM holotype and two paratypes were ". . . *polyphemus* or a subspecies thereof . . ." and that the remaining paratypes were ". . . *agassizi* or a subspecies thereof . . .". Since Grant gave no list of specimens examined, it is possible that he based his conclusions on the published photographs of the types (Legler, 1959: Pls. 7-8).

We agree that all proposals of new scientific names should stand the test of time and the scrutiny of other workers; it seems, however, that the distinctness of *G. flavomarginatus* has been established beyond reasonable doubt. It has been unequivocally established that the species occurs in the Bolson de Mapimí of northern México. There is no evidence that more than one kind of tortoise now inhabits that region. The collector of the USNM specimens was Dr. Ellswood Chaffee, as indicated by correspondence filed at the Smithsonian Institution (contrary statements notwithstanding).

As pointed out by Grant (1960:31), Legler (1959:337) erred in referring to height of shell as being slightly more than half its length; "slightly more than half its *width*" was intended. Grant further noted (*op. cit.*:30) that the carapaces of all specimens illustrated were not flared (five of the six specimens in the type series had flared shells, the holotype did not). Evidentally there is ontogenetic variation in this characteristic inasmuch as the two smallest specimens from Ceballos have unflared shells but most of the adults are at least slightly wider posteriorly than anteriorly.

Specimens of Gopherus examined.—Total of 92 as follows: *G. agassizi* (26)—U. S. National Museum 13598, 18643-5, 21160-1, 62785, 71779, 92519, 10398-9, 10412, American Museum of Natural History 64157-60, E. H. Taylor-H. M. Smith 26113, UU 3574-82; *G. berlandieri* (34)—USNM 26416, 8601, 50951, 95611-4, 100564-78, Chicago Natural History Museum 1608, 28835-39, 47368-71, 71134, University of Minnesota R-1718; *G. flavomarginatus* (15)—type series and specimens listed in Table 1; *G. polyphemus* (17)—USNM 2426, 4342, 10057, 10070, 51357, 51489-90, 53166-67, 61059, 61214, 81162, 84077, 85026, 90904, 95764, UU 1608.

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Further Studies on the Herpetology of British Honduras

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British Honduras occupies an important biogeographic position. Lying at the base of the Yucatán Peninsula, it harbors a mixture of peninsular, Central American mainland, endemic, and Antillean faunal elements. Its herpetofauna was summarized by the late Karl P. Schmidt in 1941. Since that time, many species

have been added to the country's checklist, and other additions are to be expected. Six collecting trips have been made by us to British Honduras, and some of the specimens obtained have been discussed elsewhere. The present article reports additional material, including four species not previously known from the colony.

A prior study (Neill and Allen, 1959a) may be consulted for a description of plant associations in British Honduras, and for a gazetteer of localities.

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Leptodactylus labialis (Cope).—This frog has not previously been reported from British Honduras. On July 14, 1959, a specimen (ERA-WTN No. BH-1561 in our separately catalogued British Honduras collection) was found hopping about in an open spot of the palm and pine savanna at "Highland," about 1.5 miles north of Gracy Rock, Belize District. The savanna was wet from recent rains, and the day was overcast. The following day, after a brief shower, *L. labialis* was calling in a muddy roadside puddle and adjacent yard at the community of Roaring Creek, Cayo District. The call was a short, buzzing whistle, roughly transliterated as "wheet." The puddle was transient, the immediate vicinity ruderal, the general area cleared land, the day overcast. One specimen (ERA-WTN No. BH-1469) was taken here. On October 26, 1959, the species was calling by night in a grassy area flooded by drain water from the laundry room of the Fort George Hotel in Belize, Belize District. A pair (ERA-WTN No. BH-1557-1558) were collected. The female extruded eggs a few minutes later. The breeding "pond" was temporary, the immediate vicinity ruderal, the general area one of lawns and gardens on shadow fill, the night rainy. The following day, likewise rainy, the call was heard from many flooded dooryards in Belize (Fig. 1). This day a specimen (ERA-WTN No. BH-1559) was collected in a flooded clearing at the base of Gracy Rock. The immediate vicinity was jungle, but on the edge of the savanna. On November 1, 1959, the frog was found at the Mussel Creek Rice Station of the Tennessee Agricultural Ltd., about 3.5 miles west of Boom, Belize District. Twenty-three specimens (ERA-WTN Nos. BH-1039-1057, BH-1539-1540) were tak-

en, and hundreds more seen. Adults were not noted here; the frogs averaged about 27 mm. in snout-vent length. The locality is a shallow, swampy basin, originally low savanna and swamp forest, but now modified by bulldozing. The young frogs were hopping about on sandy or muddy ground, or else hiding under logs, in cleared spots around the margin of the basin. The day was sunny; breeding calls were not heard.

In British Honduras this frog is small, the largest adults measuring about 40 mm. in snout-vent length. The dorsal ground color is distinctly green, brighter in the juvenile than in the adult. The pattern is much like that of an El Salvador example figured by Mertens (1952: fig. 35). The black markings are usually well defined. A white stripe along the upper jaw, supposedly a diagnostic character of the species, is present and generally conspicuous on the young but is not exhibited by breeding adults of either sex. Among smaller examples there is no sexual dimorphism in snout shape, but breeding males develop a prominent shelf around the margin of the upper jaw. This structure is presumed to aid in the excavation of a nesting cavity (Noble, 1954:120).

Leptodactylus melanonotus (Hallowell).—The presence of this frog in British Honduras is well established. However, certain observations on it appear to be noteworthy.

Some of our records for the species have been published (Neill and Allen, 1959a:23-24), and need not be repeated. On April 11, 1959, the frog was breeding by night in little stream-side pools along Privassion Creek, in the Mountain Pine Ridge area of Cayo District. The immediate vicinity was a rock outcrop, cut by the swift creek, and with a few shrubs; the general area was pine parkland; the night was clear. The pools were apt to be fairly permanent as a result of overflow, spray, and drainage down nearby rocky faces. Two individuals (ERA-WTN Nos. BH-1546-1547) were collected. On October 26, 1959, a large breeding chorus developed by night in a cemetery on the western outskirts of Belize, where the original mangrove swamp of the Belize peninsula was beginning to give way to freshwater swamp forest. The breeding pond was shallow, but it was densely shaded by trees, shrubs, vines, and sedges; these no doubt reduced evaporation. There were a dozen or more frothy egg masses in the water. Males, at least some of them still calling, were hiding under the masses, one male to a clutch. Eight adults (ERA-WTN Nos. BH-1497-1504) were taken. The following day, calls were heard from flooded yards in Belize; and one specimen (ERA-WTN No. BH-1560) was taken in the flooded clearing at Gracy Rock. On October 28, three non-breeding individuals (ERA-WTN Nos. 1527-1529) were collected in bright sun at the Forestry Department's Machaca Creek station, about 9.0 miles west and 5.0 miles north of Punta Gorda, Toledo

Fig. 1.—Breeding pond of *Leptodactylus labialis* in Belize, Belize District, British Honduras, November 3, 1959. During the preceding night, dozens of these frogs were calling from the shallows of the rainwater pond, along with a few *L. melanonotus*, numerous *Bufo v. valliceps*, and *Smilisca baudini*.

District. The immediate locality was a hilltop cleared by man, with several little springs or seepage areas and a growth of lush grasses. The general area was an isolated palm and pine savanna, set amid jungle. The next day, also sunny, the species was breeding in fair numbers at what is called "The Dump," about 3.5 miles east and 2.5 miles south of the Mopan Maya community of San Antonio, Toledo District. "The Dump" is a basin about 4 square miles in extent, mostly covered with shallow water and with a dense growth of emergents, including coarse grasses, sedges, and rushes (Fig. 2). Amid the thick vegetation and in full daylight the frogs were not easily caught; only one (ERA-WTN No. BH-1530) was taken. On November 1, 1959, in Belize District, one (ERA-WTN No. BH-1058) was found at the Mussel Creek Rice Station; another (ERA-WTN No. BH-1538) was calling in bright sun from the shallows of Mussel Creek at a *benque* near the bridge on the road from Boom to Bermudian Landing; and three (ERA-WTN Nos. BH-1541-1543) were found under the debris of an abandoned cohune camp about a mile from the creek in scrubby thicket.

We previously remarked that the voice of this species, at a pond in northern Belize District, could be transliterated as a single, soft

"took;" that Martin (1958:51) had described a similar call for the species in Tamaulipas, Mexico; but that Bogert (1958: band 78) had recorded quite a different note in Sinaloa, Mexico (Neill and Allen, 1959a:23). However, it is now clear that *Leptodactylus melanotus* has two distinct calls in British Honduras, and that the breeding song in this region is not very different from Bogert's recording. The "took" note does not accompany breeding activity, but may be related to the maintenance of an optimum spatial distribution by the callers.

Our specimens show little or no external trace of a post-tympanic gland. The two spines on the first finger of the breeding male are well separated, except in one individual. The largest

Fig. 2.—Breeding pond of *Leptodactylus melanonotus;* a portion of "The Dump," a swampy tract in Toledo District, British Honduras, October 29, 1959. The frogs were calling throughout the flooded basin. *Rana pipiens* was present but not calling.

example is a female of 45 mm. snout-vent length. The dorsal ground color is drab grayish in both young and adults, often so dark that the pattern of blackish spots is scarcely to be distinguished. When evident, the pattern is much like that of an El Salvador frog figured by Mertens (1952: fig. 36). A few young specimens display a short, white streak immediately below the eye. Two small individuals have an orange suffusion in the groin and on the concealed surfaces of the thigh. This character was found to be variable in a Nicaraguan series (Noble, 1918:325). A single young frog has one large and several small warts or glandular areas on each side of the vent, and a conspicuous cluster of light-colored warts in the groin. The occurrence of such light-colored glands or warts characterized almost all specimens from an area in

Veracruz, Mexico (Werler and Smith, 1952:552). In all our examples the under surfaces are reticulated with dark, breeding individuals being very heavily marked. Firschein and Smith (1957: 221) noted heavy ventral reticulation in a frog from Quintana Roo, Mexico, and an absence thereof among Veracruz individuals.

Eleutherodactylus sandersoni Schmidt.—This species was described from six specimens collected by I. T. Sanderson at "Double Falls, west of Stann Creek, British Honduras" (Schmidt, 1941: 485). Schmidt evidently could not place the locality more definitely, and omitted it from his map (fig. 38). Burger (1950:64) could not find it, and tentatively put it in Toledo District. We cannot find the name "Double Falls" on any map, and Sanderson's (1941) account throws no light on the problem. The name must be of very local application if not a coined one. Approximately 12.5 miles west of the Carib community of Stann Creek, there are two waterfalls about 0.4 miles apart on Big Eddy Branch of North Stann Creek, in Stann Creek District. As these falls are roughly 4.0 miles northwest of Silkgrass Forest Reserve, and as Schmidt gave "Silkgrass" as a locality for various other species taken by Sanderson, we regard the falls as the probable type locality of *E. sandersoni* (and of *Pliocercus elapoides semicinctus* Schmidt).

Other localities for this frog have not been reported. On July 17, 1959, a specimen (ERA-WTN No. BH-1479) was found by day at the margin of Silver Creek, about 1.4 miles upstream of the point where this stream crosses Hummingbird Highway, in Cayo District. The elevation was probably a little under 2,000 feet. Silver Creek, a small tributary of the Sibun River, is swift, clear, cold, and rocky, with a steep gradient and numerous waterfalls. It is bordered by dense rainforest. The frog was hopping about on streamside rocks (limestone) during a rain.

Our frog agrees well with Schmidt's detailed description of the holotype, except that there is a vague suggestion of a ventral disk in the form of an indistinct fold of skin across the chest, and that the heels overlap slightly (instead of just touch) when the legs are placed at right angles to the body. These differences are probably attributable to the relative youth of our specimen, which is but 21 mm. in snout-vent length. Schmidt's holotype was 67 mm. in this measurement. The color of the Silver Creek frog, in the freshly preserved condition, is much like that of the holotype. The dorsum is dark gray, becoming a lighter gray toward the snout. There are a few blackish markings on the back, but these are poorly defined. There is an interocular dark band, its anterior border fairly distinct but its posterior one fading into the dark background. The sides, the edges of the venter, the chin, and the throat are mottled with dark brown. The sides of the head are dark gray. There are blackish spots along the edge of the upper jaw, one at the tip and

three on each side, the spots separated by whitish areas. The limbs are dark-banded, rather obscurely so except on the anterior portion of the thigh, where the markings form about five diagonal bands. The posterior surface of the thigh is dark brown clouded with blackish, and minutely punctulated with dull yellow. The only significant color character not mentioned by Schmidt is a fine white line, beginning on the tip of the lower jaw and extending along the midline of the throat. It is apt to be evanescent in preservatives. This line is found in several species of the genus, and may afford a clue as to relationships. It occurs, for example, in *Eleutherodactylus ranoides* (Cope) which Schmidt thought possibly related to *E. sandersoni*.

Syrrhophus leprus Cope.—The southern part of Toledo District is somewhat isolated from the remainder of British Honduras by the Maya Mountains uplift. The district's herpetofauna will be the topic of a separate paper. In the meanwhile it is desirable to note the presence of this frog, a member of a genus hitherto unknown from the country. One specimen (ERA-WTN No. BH-1525) was taken on October 28, 1959, at a point about 3.9 miles north of San Antonio, Toledo District. A description follows.

Snout-vent length 26 mm., with the characters of the genus as redefined by Firschein (1954), except that in the preserved condition the post-tympanic and inguinal glands are scarcely evident externally. Three palmar tubercles. Digits but slightly widened at the tips. Under side of thigh faintly granulated, the skin otherwise quite smooth ventrally, laterally, and dorsally. Eyes large, but well separated by a flat interorbital space; maximum width of upper eyelid contained about 1.6 times in aforesaid space. Diameter of tympanum contained about 2.7 times in eye diameter. Dorsum tannish with rounded, dark brown spots most of which are discrete, not confluent. Sides with silvery-white flecks. Under surfaces whitish except for a faint darkening around the edge of the lower jaw. Whitish flecks on forelimbs, hindlimbs, and sides of head below and behind the eyes. Sides of snout blackish, without flecks.

Syrrhophus leprus has been reported on the Atlantic lowlands from southern Veracruz, Mexico to El Petén, Guatemala (Duellman, 1958:8). Any species so distributed is apt to be found in British Honduras. Nevertheless it was surprising to discover the frog so far south. Our locality is about 80 miles southeast of Tikal, the southernmost Petén record (Stuart, 1958:17), and on the opposite side of a mountain range. Consistent differences from typical *leprus* may appear when a series becomes available. In our lone example the dorsal pattern is less bold and less reticulate than in the Veracruz specimens figured respectively by Werler and Smith (1952: fig. 2) and by Duellman (1958: fig 2).

The British Honduras frog was found at night on a dirt road through second growth rainforest and jungle. There were shale outcroppings nearby. The area is constantly humid; average annual rainfall is probably about 175 inches.

Conophis concolor Cope.—The relationship of this snake to *C. lineatus* (Duméril, Bibron, and Duméril) has remained uncertain. Cope (1867:318) originally described it as a full species. Schmidt and Andrews (1936:178) also favored specific status for it. Smith (1941:122) considered it to be a subspecies of *C. lineatus*. We remarked that a British Honduras example of *C. l. dunni* showed no approach to *concolor* (Neill and Allen, 1959a:56). More recently we noted that a population of *C. l. dunni*, in the Mountain Pine Ridge area of Cayo District, British Honduras, showed a slight approach to *C. l. lineatus* but none toward *concolor*, thus bolstering the contention that the latter and *dunni* are not intergrading subspecies (Neill and Allen, 1960:148).

On April 25, 1960, a specimen of *Conophis concolor* (ERA-WTN No. BH-1562) was collected at a point about 13.0 miles west and 1.5 miles south of Belize, Belize District. It provides the first record for the country. Its noteworthy features are: total length 450 mm., tail length 101 mm. Ventrals 162, counted in the fashion of Dowling (1951); subcaudals 68 pairs (a male); scale rows 19-19-17; supralabials 8; infralabials 9; preocular 1; postoculars 2; temporals 2+3 (right side) and 2+2. Color in life: dorsum uniformly a dull greenish-gray (16 C 4 in the terminology of Maerz and Paul, 1950), becoming a little lighter on the two lower scale rows. Venter flesh-colored (11 D 5), with an iridescent bloom. Some greenish-gray on the chin, darkening the centers of the chin shields and the edges of the infralabials. Supralabials flesh, the first six bordered ventrally with greenish-gray. A reddish-brown (56 L 12) stripe beginning on the anterior portion of the nasal scale, extending through the lower half of the eye to terminate at the beginning of the neck; this stripe narrowly black-bordered above and below. A short paravertebral line of black dots on the nape, meeting its fellow of the opposite side on the posterior tips of the parietals.

Conophis concolor is now known to range from Yucatán southward to central British Honduras, and thence eastward through Honduras. *C. lineatus dunni* ranges from Costa Rica northward through Honduras, thence northward at least to central British Honduras, and presumably still farther northward toward the Mexican state of Veracruz where *C. l. lineatus* exists. This widely overlapping distribution implies that *C. concolor* and *C. l. dunni* are not subspecifically related. Conspecificity was postulated by Smith (1941:123) on the basis of one supposed intergrade catalogued as from El Salvador but thought by him to be from El

Petén, Guatemala, as indicated on an accompanying label. El Petén is the Guatemalan department that borders British Honduras. With *C. concolor* in Belize District, and *C. l. dunni* about 50 miles to the southwest in Cayo District, one would scarcely expect intergradation still farther west, in El Petén.

The Belize District *Conophis concolor* differs from the Cayo District *C. lineatus dunni* (ERA-WTN No. BH-298, BH-300) in (1) the absence of body stripes; (2) reduction of extent and intensity of head stripes; (3) reduction of extent and intensity of supralabial and gular dark markings; and (4) absence of dark stippling on the tips of the ventral plates. The peculiarities of the *C. concolor* reflect merely a comparative lack of melanin. There are no differences in scale characters, even the ventral and subcaudal counts agreeing closely. The similarity in scalation extends beyond British Honduras; scale data for Costa Rican *dunni* (Taylor, 1951:145), for Honduras *dunni* (Savage, 1949:485), for British Honduras *dunni* and *concolor*, and for Yucatán *concolor* (Schmidt and Andrews, 1936:178; Smith, 1938:7) are all much the same. It seems possible that the two forms are but pattern phases, with different but widely overlapping distribution and perhaps with the production of occasional intermediates. There are several instances

Fig. 3.—ERA-WTN No. BH-1562, *Conophis concolor;* collected 13.0 miles west and 1.5 miles south of Belize, Belize District, British Honduras, April 25, 1960.

of known or suspected pattern dichromatism among snakes of the southwestern United States and northern Mexico (Smith, 1952:94); and there is growing evidence of possibly comparable dichromatism among species of southern Mexico and Central America (*e. g.*, lined and unlined phases of *Stenorrhina f. freminvillei*, the *bicolor* and *sumichrasti* phases of *Loxocemus*, perhaps the sympatric *Dryadophis sanguiventris* and *D. melanolomus alternatus*). If *concolor* and *dunni* are but pattern phases, the Central American population of *C. lineatus* will stand as *C. l. concolor* Cope.

The unlined specimen is figured (Fig. 3). It was found in an open "oak island" of the palm and pine savanna. Our lined individuals were from pine parkland. Both the savanna and the parkland are characterized by graminoids and *Pinus caribaea*, with scattered groves of oaks.

Ficimia p. publia Cope.—The presence of this species in British Honduras has been mentioned casually (Neill, *in press*), but no actual specimen from that country has been cited. Anthony Wolffsohn called our attention to an example taken by him at Gallon Jug, Orange Walk District, in 1952. It was sent to the Chicago Natural History Museum. The specimen (CNHM No. 69232) is a male, total length 420 mm., tail length 75 mm. Scale rows 17 at midbody; ventrals 140; anal divided; subcaudals 40 pairs. Supralabials 7, the third and fourth entering the orbit; infralabials 6, the first three pairs in contact with the anterior chin shields. Preocular 1; postoculars 2; internasals present, widely separated by the rostral. Dorsal blotches 26 on body and 8 on tail, very dark brown.

A tendency toward very dark blotches apparently characterizes the more southerly examples of the species (Smith and Taylor, 1941:362-363).

Lampropeltis doliata polyzona Cope.—There are unexplained anomalies in the distribution of *L. d. polyzona* and its near allies. *L. d. blanchardi*, supposedly a northern Yucatán derivative of *polyzona*, was also found in Guerrero, on the Pacific lowlands of southern Mexico. Stuart (1935:5) thought that snakes from the latter area merely showed fortuitous resemblance to *blanchardi*, in actuality being intergrades between *polyzona* and *L. d. nelsoni*; while Smith (1942:199) held that *blanchardi* had evolved twice, independently.

As the characters of *Lampropeltis doliata blanchardi* are primitive for its species (Blanchard, 1921:143; Stuart, 1935:6); as the Guerrero lowlands and Yucatán support the same relatively dry plant associations (Leopold, 1950: fig. 1), to which *blanchardi* is presumably adapted; and as the disjunct distributions of several reptiles imply a past period of more widespread aridity in this part of the world (Neill and Allen, 1959a:60; Stuart, 1948:53, 57,

78); we suggest that *blanchardi* is a primitive, somewhat undifferentiated, relict form that has persisted in two well separated but ecologically rather similar dry areas. (There is an interesting parallel in the distribution of another supposed "coral snake mimic;" as noted by Smith and Chrapliwy (1957:233), *Pliocercus andrewsi* is known from northern Yucatán and also Pacific Chiapas.) If the suggestion is correct, then *blanchardi* and *polyzona* might not intergrade smoothly, but sporadically or not at all. The relationship of the two should be clarified by specimens from British Honduras and Quintana Roo.

The only British Honduras specimens mentioned in the literature are two supposedly from Belize (Boulenger, 1894:204; Schmidt, 1941:503). One of these was collected in the days when the name "Belize" was generally applied to the whole country or region. Early "Belize" records, and even some later ones, cannot unhesitatingly be accepted as pertaining to the present capital city (Allen and Neill, 1959). The other "Belize" example was found by Schmidt in the natural history cabinet of a missionary. Of course, missionaries with natural history interests are apt to receive from their parishioners various specimens brought from afar. Belize stands at the tip of a peninsula which except for shallow fill supports mangrove swamp; it is an improbable locality for *Lampropeltis doliata polyzona,* which frequents openings in rainforest and jungle. At any rate, the "Belize" specimens did not approach *blanchardi* (Schmidt, *loc. cit.*).

A male individual (ERA-WTN No. BH-1194) was taken at Regalia, Stann Creek District, in April, 1960, by Charles L. Payne. Total length 1160 mm., tail length 170 mm. Ventral count high, 240; subcaudals 52 pairs. Yellow annuli 18 on body and 5 on tail, the former mostly somewhat interrupted ventrally by encroaching black. Red rings decided longer than the triads (black-yellow-black). Some scales of the red areas vaguely darkened toward the tip. Snout black, with a white crossband. The snake is illustrated (Fig. 4, upper). It is a *polyzona* with no approach toward *blanchardi.*

Another example was collected by Anthony Wolffsohn at Augustine, Cayo District. The snake is not at hand, but Mr. Wolffsohn provided photographs of it. One of these is reproduced here (Fig. 4, lower). Yellow annuli 23 on body and tail, somewhat interrupted with black ventrally. Red rings longer than triads. Some scales of the red areas vaguely darkened toward the tip. Snout black with a light crossband. The ventral count is not known, but the color characters are those of *polyzona* and show no approach toward *blanchardi.*

Somewhat farther west, in El Petén, the snakes are typical *polyzona* with no approach toward *blanchardi,* even though this

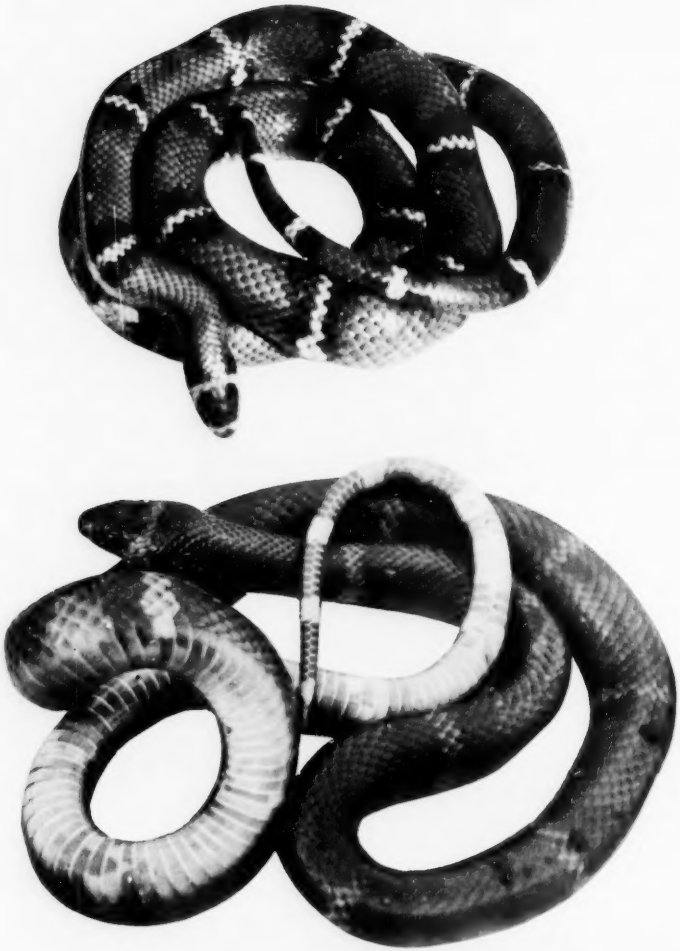

Fig. 4.—Upper: ERA-WTN No. BH-1194, *Lampropeltis doliata polyzona*; collected at Regalia, Stann Creek District, British Honduras, April, 1960. Lower: *L. d. polyzona* from Augustine, Cayo District, British Honduras. Figures not to same scale.

Guatemalan department is a zone of transition in many species (Stuart, 1935:5). North of El Petén, in southern Campeche, Mexico, records are lacking. The only reported example from Quintana

Roo, Mexico, is a *blanchardi* with no approach to *polyzona* (Peters, 1953:229).

So far as present records indicate, the respective ranges of *Lampropeltis doliata polyzona* and *L. d. blanchardi* are separated by a stretch of country at least 150 miles wide. Much of this intervening area consists of palm and pine savanna, brushy thicket, pineapple and sisal plantations, and canefields—associations not apt to harbor the species.

Thecadactylus rapicaudus (Houttuyn).—This gecko was reported by Günther (1885-1902:81) from British Honduras. Schmidt (1941) omitted the species from his British Honduras checklist. On ecological and zoogeographic grounds we recommended acceptance of Günther's record (Neill and Allen, 1959b:236). We can now state with assurance that the species occurs in the country. A specimen (ERA-WTN No. BH-1203), 66 mm. in snout-vent length, was taken at Crique Sarco, Toledo District, on April 26, 1960. It was found under the axil of a huge, dead frond on a cohune palm.

The dorsum of the lizard was light brownish with about 6 or 7 irregular crossbands of a darker brown. In life, the under sides of the digital lamellae were powder blue. This is the case with several gekkonid species, of both the Old World and the New. The color is probably not significant *per se*; it appears to be a Tyndall blue, the optical effect of melanin deposits lying beneath pellucid tissue.

Ameiva species.—On April 25, 1960, an *Ameiva* (ERA-WTN No. BH-1202) was collected at a point about 13.0 miles west and 1.5 miles south of Belize, Belize District. It was small, only 56 mm. in snout-vent length, and differently patterned from any other specimen we had seen. Its scale characters were those of the British Honduras population of *A. undulata*. This population, which has been called *A. u. hartwegi* (Neill and Allen, 1959a:43; Smith and Laufe, 1946: fig. 7), is more or less intergradient with *A. u. gaigeae*, for in adults the vertical light bars between axilla and groin number 11 or 12, and the total femoral pore count of the male is 38 or 39. Perhaps our small lizard merely exhibits the normal juvenile coloration of *hartwegi* or *hartwegi-gaigeae* intermediates. However, according to Stuart (1942:147), all forms of the *undulata* group, when young, display a light brown mid-dorsal area and a lateral pattern of dark and light stripes. Our example is not so marked.

This juvenile is rather simply patterned. It is olive above, becoming more brownish on the head and tail. A lateral band of rich reddish-brown or maroon begins on the side of the snout and continues to the groin. The band is sharp-edged above but not light-bordered; below, it fades out onto the venter. The limbs are dull brown. The back, upper sides, and the dorsum of limbs and

tail all bear small, irregular flecks of black. There are no lateral light stripes or spots.

In contrast, the adult of *Ameiva undulata hartwegi* is usually bright velvety green above, becoming bronze on the tail; the lateral band consists of vertical spots of bright blue, separated by bronze-edged spots of black; black flecking is indistinct, except perhaps posteriorly. An accompanying photograph (Fig. 5) contrasts the small lizard with a typical adult of British Honduras *undulata*. The latter specimen was collected by Anthony Wolffsohn in a *milpa* near Gallon Jug, Orange Walk District.

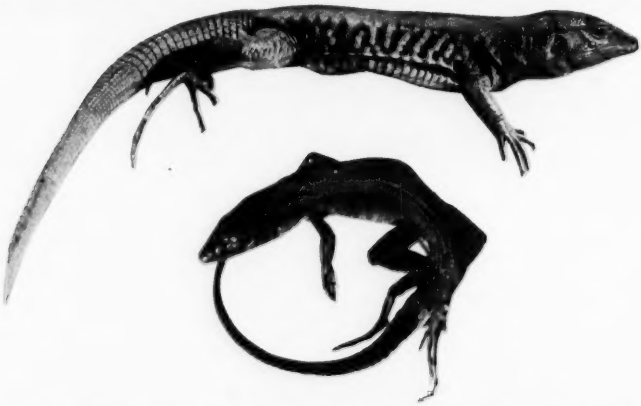

Fig. 5.—Upper: Adult of *Ameiva undulata hartwegi*, showing approach to *A. u. gaigeae* in the relatively high number of light spots between axilla and groin; from near Gallon Jug, Orange Walk District, British Honduras. Lower: ERA-WTN No. BH-1202, juvenile of *Ameiva* species, collected 13.0 miles west and 1.5 miles south of Belize, Belize District, British Honduras. Note lateral maroon band and absence of lateral stripes. Figures not to same scale.

The pattern of the small lizard may well be adaptive. The reddish-brown lateral band resembled clay soil; the olive dorsal zone, dulling to brown on the extremities, matched dull green and brown grasses; the dark flecks suggested shadows and bits of ground debris. Thus the small lizard was extremely well camouflaged in the savanna habitat. It was found in an open "oak island" of the palm and pine savanna in company with a racerunner lizard of the *Cnemidophorus sexlineatus* group. We have not seen any other British Honduras *Ameiva* in so open a place.

Crocodylus acutus Cuvier.—Schmidt (1924:85) did not encounter this crocodile anywhere in British Honduras, although he found *C. moreleti* to be common near Belize. Later he located in collections one *acutus* from "Belize" and two from "British Honduras" (1941:489). In this country we found a few *moreleti* and

no *acutus*; however, we thought that the latter occurred at Belize, for local residents described the presence of a large crocodile in the *acutus* habitat (Neill and Allen, 1959a:33). We can now verify the persistence of *acutus* at Belize, where a 3-foot example was collected on the night of October 31, 1959. It was within the city limits, in mangrove swamp.

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The Eggs and Young of the Spring Salamander, *Pseudotriton porphyriticus*

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The eggs of *Pseudotriton porphyriticus* have been reported found in the field on only one occasion (Green, 1925). Noble and Richards (1932) successfully induced egg-laying in this species and described and figured the egg capsules. Oliver (1955) indicated that *P. porphyriticus* did not guard its eggs but Bishop (1924) found a female of a closely related species, *Pseudotriton danielsi,* guarding a hatching egg mass during the month of October in North Carolina. [The Spring Salamanders were until recently (Grobman, 1959) in the genus *Gyrinophilus.*]

Although the larvae of this species are relatively abundant, few specimens with a total length of less than 30 mm. have been taken. In New York, Bishop (1941) reported a 27 mm. larva taken on April 5, a 28 mm. larva on April 28, and a 25 mm. larva taken on July 29. Pope (1915) found five larvae, each with a total length of 25 mm., on April 19 in Maine. From these records, Bishop (1941) concluded that *P. porphyriticus* has a spring or summer hatching period over at least part of its range. He also assumed that the hatchlings of *P. porphyriticus* were the same size as those of *P. danielsi* which hatches at a length of 25 mm. (Bishop, 1924).

In 1956 and again in 1958, the eggs of *P. porphyriticus* were found in a small spring located within a spruce-fir forest of Whitetop Mountain, Grayson County, Virginia. The spring is at an altitude of 5250 feet and runs for less than 200 linear feet before disappearing back into the ground. To the best of my knowledge, the flow is permanent. The depth of water varies from 2 to 8 inches and the current is slow. The bed and banks of the spring are composed of large fragments of granitic bed-rock with smaller rocks and mud filling the interstices between the larger rocks. A thick canopy of spruce trees surrounding the spring allows little direct sunlight to reach the water. There is a dense growth of ferns, and in the spring most of the larger rocks are covered by a thick blanket of moss.

The first egg mass, consisting of 66 eggs, was found on August 6, 1956. The attending female, measured from the tip of the snout to the posterior angle of the vent, had a length of 91.0 mm. In contrast to other adults taken in this spring, she was sluggish and easily collected.

The nest site was beneath a large spherical rock partly buried in the muddy bank of the spring. Water flowed around and under the rock but not over it. The water temperature beneath the rock was 12° C. Each egg was pear-shaped in outline and individually

attached to the undersurface of the rock by its outer capsule. The capsules were closely pressed together and formed an almost solid gelatinous mass covering a circular area with a diameter of approximately 7 inches. The mass was only one egg layer thick.

The eggs found by R. W. Wehrle in Pennsylvania on August 8 (Green, *op. cit.*) were in early stages of development. The eggs found at Whitetop on August 6, however, contained well-developed embryos. The fore and hind limb buds were present but lacked digits. The embryos had long slender branched gills, pigmented eye spots, and poorly defined external nares. The dorsal pigmentation was weak, consisting of scattered melanophores, and formed no definite pattern. The dorsal and ventral caudal fins were well formed and lightly pigmented. A large cylindrical mass of pale yellow yolk extended from the gular fold to the vent.

Most of the eggs were preserved on the day they were collected but 13 of them were kept over night in a large container of water. On August 7, these eggs hatched but the young were considered to be premature. The hatchlings spent most of the time resting at the bottom of the container but were able to swim rapidly for short distances when disturbed. The swimming movements were poorly coordinated and the hatchlings tired quickly.

The second cluster, consisting of 41 eggs, was found on July 14, 1958. The attending female had a snout-vent length of 95.0 mm. As in the case of the first attending female, she was sluggish and easy to catch. The second egg mass was also attached to the underside of a large rock partly buried in the muddy bank of the spring. The outline of this cluster was more elongate than the one found in 1956, measuring about 8 inches long by 3 inches wide (Figure 1).

The embryos were less advanced than those found in 1956. They were pigmentless. The forelimb bud was weakly developed and there was no indication of a hind limb bud. The dorsal tail fin was present, but weak, and the ventral tail fin was lacking. The gills were merely three small finger-like projections on each side of the head.

Nine of the eggs were preserved the day they were collected. The rest of the eggs were carfully removed from the undersurface of the rock and were placed in a large glass finger bowl together with the attending female. The water in the finger bowl was changed several times a day and the temperature fluctuated from 12° C to 18° C.

On July 20, three eggs were removed from the container and preserved. The embryos in them had developed pigmented eye spots. The forelimb bud had elongated but digits were still lacking. The hind limb bud was absent. The gills were long and slender but unbranched. The tail had well formed dorsal and ventral fins which, like the dorsum, were lightly pigmented with scattered melanophores.

On July 28, all but three of the eggs hatched. Two of the unhatched eggs and three hatchlings were preserved. These hatchlings, like those obtained in 1956, were considered to be premature. The eyes were well developed but the nares did not connect with the interior of the mouth. The forelimb had distinct digits but lacked digital joints. The hind limb bud was well formed but lacked digits. The gills were long, slender, and branched. Dorsal pigmentation was more intense than in the embryos examined on July 20, and there was a sharp line of demarcation at the level of the limb insertions between the pigmented dorsum and the unpigmented venter. The tail was proportionally longer and more densely pigmented than in the embryos.

On July 30, the remaining hatchlings were preserved. There was still no indication of digital development on the hind limb buds. Dorsal pigmentation was more intense than at hatching and revealed the beginning of the reticulated pattern so characteristic of the larvae of this species. The hatchlings at this time measured 10 mm. from snout to vent and 15 mm. in total length.

In an effort to determine the approximate size of *P. porphyriticus* at hatching, collections were made throughout the fall and spring of 1958-59. On April 17, 1959, three small larvae were collected on the south side of Whitetop Mountain at an altitude of 3600 feet. The total lengths of these larvae were 24.5, 25.0, and 27.0 mm.

On May 4, 1959, five small larvae were taken at Whitetop in the same spring in which the eggs were found previously. These larvae were 23.0, 23.0, 24.0, 24.5, and 26.5 mm. long.

On June 19, 1959, three more small larvae were taken in this same spring. In total length, they were 26.0, 26.5, and 27.0 mm. Thus, almost half of the small larvae collected during the spring at Whitetop Mountain, were smaller than the fall hatchlings of *P. danielsi* (Bishop, 1924).

The hatchlings obtained during the summers of 1956 and 1958 were premature but they give some indication of the hatching period for this species in the mountains of Virginia. Considering the advanced stages of development of the embryos when found in the field, it is likely that the hatching season for *P. porphyriticus* corresponds to the fall hatching season for *P. danielsi* in North Carolina (Bishop, 1924). The apparent lack of small larvae in the fall is probably due to the hatchlings remaining in or near the nest site during the first winter of life. Indeed, our ignorance of the eggs of this widely distributed species is a tribute to the relative inaccessability of these nesting sites.

The small size of the larvae collected in April, May, and June, 1959, indicates that the hatchlings of *P. porphyriticus* are smaller than those of *P. danielsi*. Moreover, these larvae are as small, or smaller, than those collected at comparable dates in the northern part of the range of *P. porphyriticus* (Pope, 1915; Bishop, 1941). Asuming that the size at hatching is uniform over the geographic range of the species, it is likely that the larvae considered by Bishop (1941) to be spring hatchlings were actually about six months old and represented hatchlings from the fall. Although more data are needed, the available information seems to indicate that *P. porphyriticus* has a fall hatching period with little, if any, growth occurring during the first winter.

Figure 1.—Egg mass of *Pseudotriton porphyriticus*. The rock has been rolled back to reveal the undersurface.

Oliver's contention (1955) that *P. porphyriticus* does not guard its eggs was possibly based on the description of the eggs of this species by Green (1925). The latter made no mention of an attending or guarding female. Since Bishop (1924) found a female of *P. danielsi* guarding eggs and, in both instances, a female of *P. porphyriticus* was found with the eggs at Whitetop Mountain, it can be assumed that the brooding behavior of this species agrees with that of other plethodontid salamanders whose habits are known.

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Additions to the Herpetological Fauna of Isla Cerralvo in the Gulf of California, Mexico

Richard Etheridge

Isla Cerralvo is the southernmost island in the Gulf of California. Its nearest point lies six and one-half kilometers off the eastern coast of the peninsula of Baja California, southeast of Bahiá de La Paz. The island is about 28 kilometers long and six and one-half kilometers in greatest width. It is composed of a single mountain ridge extending nearly its entire length and reaching an altitude of 755 meters. Most of the shoreline is abrupt and rocky, but is occasionally interrupted by short, narrow stretches of sandy beach. At the southern end of the island there is a wide area of high, rolling sand dunes between the base of the mountains and the sea. From July 14 to July 22, 1960, Mr. Allan Schoenherr and I encamped near the edge of this sand dune area and collected several herpetological species that have not yet been reported from the island: *Scaphiopus couchi*, *Phyllodactylus unctus*, and *Callisaurus draconoides draconoides*. We also obtained a number of other forms, already known to occur on the island, including the recently described *Chilomeniscus savagei* (Cliff, 1954). The new records are of interest because of Cerralvo's peculiar herpetological fauna and the significance of this fauna in zoogeographic studies of the region. The specimens on which these new records are based are in the collections of the California Academy of Sciences (CAS), San Francisco, California.

Scaphiopus couchi (CAS 88621).—An individual was collected at night near the outer fringe of beach vegetation, about 30 meters from the water's edge. It is a male, and measures 51 mm. from snout to anus. The color in life consisted of a very pale yellow-gray background with broad, irregular markings of dirty yellow. Small gray spots were scattered irregularly over the back and small yellow spots along the sides. The venter was a translucent yellow-gray; the throat was white. The inner surfaces of the wrist and first two fingers were dark brown. The island specimen has been compared with a series of 39 *Scaphiopus couchi* collected a week later on the peninsula, 18 kilometers northwest of La Paz. There is much variation in the peninsula specimens, both in degree of paleness and configuration of pattern, but the Cerralvo individual was lighter than any of them. In view of Stroud's finding (1949), that white *Scaphiopus couchi* from White Sands, New Mexico, would darken after being kept for a time in the laboratory, there is no reason to believe that the paleness of the Cerralvo specimen is indicative of a genetic difference between island and peninsula populations.

This is the first report of an amphibian from any of the islands

on the peninsular side of the Gulf of California. At the time this specimen was collected the La Paz region, and presumably also Isla Cerralvo, had been without rain for over five months. Two days later (July 19) the fringe of a passing hurricane brought several hours of heavy rains to the island, but left no standing water. On the night following the hurricane the sand was already dry at the surface, and no *Scaphiopus* were either seen or heard calling. There is no permanent fresh water on the island and it would seem that prolonged heavy rains—of rare occurrence in this region—must be necessary for this amphibian to complete its life cycle. *Bufo punctatus* is known from the nearby peninsula. It would not be surprising if this form were eventually discovered on Cerralvo as well.

Callisaurus draconoides (CAS 88623-5).—This species is reported here from Cerralvo for the first time. It is abundant in the southern sand dune area and adjacent beaches, and may also occur on some of the interrupted narrow beaches along other parts of the island's coast. No *Callisaurus* were seen on the lower slopes of adjacent mountains, or in the dry canyons that lead to the beach and dune area. The Cerralvo specimens appear to be identical with *Callisaurus draconoides draconoides* collected from the vicinity of La Paz on the nearby peninsula.

Phyllodactylus unctus (CAS 88622).—An individual was collected during the day, under loose rocks of a canyon wall about one kilometer inland from the southern beach. It is an adult female measuring 56 mm. from snout to anus. A single large egg is visible through the translucent venter. The island specimen does not appear to differ from peninsula specimens of *Phyllodactylus unctus*. This is the first Cerralvo record for this species.

Dipsosaurus dorsalis lucasensis.—Van Denburgh (1922) records this form from Isla Cerralvo but gives no details of its occurrence there. It is abundant in the sand dune and beach areas and also invades the dry canyons that lead to them, but does not occur on the mountain slopes. Dr. Jay Savage and Mr. Arnold Kluge inform me that their studies of geographic variation in *Dipsosaurus dorsalis* have revealed no apparent differences between Cerralvo and lower peninsula populations.

Chilomeniscus savagei (CAS 88626).—An individual was collected about 9:00 p.m. on a moonless night in the southern sand dune area. Tracks of these snakes are everywhere abundant in the dunes, and this individual was discovered partly buried in the sand after following one of these tracks for some time. The specimen is an adult female, 210 mm. in length from snout to anus; the tail is 24 mm. long. There are 136 ventrals and 21 subcaudals not counting the terminal spine. There are 15 scale rows behind the head. This number is reduced to 14 by the disappearance of the

vertebral row above the seventh ventral, and to 13 by the union of the paravertebral scale rows above the ninth ventral. From the ninth ventral to the anus the number of scale rows remains at 13. There is a broad, brown band across the top of the head, 25 brown bands around the body and five around the tail. The tip of the snout and the spaces between the dark bands are white with a pale pink tinge. The first dark band of the body is five scales wide, the second four scales wide, and all others are three and one-half scales wide. The white interspaces are two and one-half to three and one-half scales wide. All of the dark bands are complete, except the first which is incomplete ventrally. The dark bands occupy from two and one-half to three and one-half ventrals. The number and arrangement of scales and bands are in close agreement with the holotype. Single median apical pits are present on all dorsal scales. They are inconspicuous and were possibly overlooked by Cliff (1954) who states that apical pits are absent in the holotype and paratype. The stomach and lower intestine contained the remains of soft-bodied insects, probably beetle larvae.

In view of the sand burrowing habits of *Chilomeniscus* it seems likely that *C. savagei* is restricted to the sand dune-beach areas of Cerralvo. Outside these areas the ground is rocky and the terrain very rugged.

Masticophis flagellum piceus.—An adult male was collected during the day in the southern sand dune area. Several others were seen in the vicinity but escaped capture. The color is like that described by Cliff (1954) for three other specimens from Cerralvo —very dark brown above and cream below—and supports his contention that only one color phase is established on the island.

Eridiphas slevini.—This species may be added to the snake fauna of Ilsa Cerralvo. A specimen in the collections of the California Academy of Sciences (CAS 88985) was collected there by Michael Soulé and Robert Crippin.

Isla Cerralvo has no permanent inhabitants and no native large mammals, although untended goats have roamed the island for many years. Local shark fishermen, who occasionally encamp on the island's southern shore, told us that feral house cats are now common on Cerralvo. Although we actually saw none, their cries at night and their skeletons, which we found by day, attest to their presence. I do not know how long they have inhabited the island, but on other small islands, *e. g.* Navassa and Beata in the West Indies (see Barbour, 1935), the predation of feral house cats has drastically reduced or exterminated the native populations. All of Cerralvo's lizards, including the endemic forms *Sator grandavus, Ctenosaura hemilopha insulana* and *Cnemidophorus ceralbensis,* still appear to be very common, but the unfortunate introduction of house cats may seriously affect their future.

The reptiles and amphibian that are now known to occur on Isla Cerralvo are listed below. Forms preceded by an asterisk are endemic to the island.

* *Scaphiopus couchi* Baird
Phyllodactylus unctus Cope
* *Ctenosaura hemilopha insulana* Dickerson
Dipsosaurus dorsalis lucasensis Van Denburgh
* *Sator grandaevus* Dickerson
Callisaurus draconoides draconoides Blainville
* *Cnemidophorus ceralbensis* (Van Denburgh and Slevin)
* *Chilomeniscus savagei* Cliff
Masticophis flagellum piceus (Cope)
Lampropeltis getulus conjuncta Cope
Eridiphas slevini (Tanner)
* *Crotalus enyo cerralvensis* Cliff
Crotalus mitchelli mitchelli (Cope)

I am grateful to Dr. Jay Savage for information concerning pertinent literature and systematic problems relevant to this study, and to Mr. Allan Schoenherr for his assistance in the field.

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NOTES

ERIDIPHAS SLEVINI (TANNER) ON CERRALVO ISLAND, GULF OF CALIFORNIA, MEXICO.—During a California Academy of Sciences expedition to Baja California, Mexico, a single specimen of *Eridiphas slevini* (Tanner) was collected on Cerralvo Island in the Gulf of California on March 6, 1960. It was discovered under driftwood high on the beach on the southwestern end of the island. The third known specimen of the species, it is now deposited at the California Academy of Sciences (CAS 88985).

Two previously known specimens of *Eridiphas* were collected on the southern third of the peninsula of Baja California; the first was taken near Loreto, in 1921, and the second east of La Paz, in 1959. These two specimens were assigned to the genus *Hypsiglena* until the appearance of a recent paper by Leviton and Tanner, (1960, Occ. Pap. California Acad. Sci., no. 27) in which the species *Hypsiglena slevini* was transferred to the new monotypic genus *Eridiphas*.

Eridiphas is apparently intermediate between *Hypsiglena* and *Leptodeira* (Leviton and Tanner, *supra cit.*) and matches well the prophetic description for the common ancestor of these two genera given by Duellman (1958, Bull. American Mus. Nat. Hist., vol. 144). That *Eridiphas* occurs on Cerralvo Island is of particular interest inasmuch as this island is a repository for other relict forms.

The individual reported on here closely resembles the other two known specimens in the characteristics examined. The only distinct difference noted is a higher number of dorsal blotches, with 63 as compared with 52 on the specimen collected near La Paz and 51 on the specimen from the vicinity of Loreto.

The following observations were made after preservation: Female; ventrals 186; subcaudals 58; dorsals 21-23-17; upper labials 8; lower labials 10; divided nasal; single loreal; 2 preoculars; 2 postoculars; temporal formula 1 + 2; 63 dorsal blotches; 14 maxillary teeth; standard length (snout-vent) 408 mm; tail length 78 mm; head length 19 mm; snout length 4.2 mm; diameter of eye 3 mm.

The expedition was sponsored by the Belvedere Scientific Fund. The field work was conducted during the author's tenure as a National Science Foundation predoctoral fellow.—*Michael E. Soulé, Dept. Biol., Stanford Univ., California.*
of Natural History, Raleigh.

THE SOUTH AMERICAN HYLID FROG NAMES *SPHAENORHYNCHUS, DRYOMELICTES,* AND *SPHOENOHYLA.*—In 1938, Lutz and Lutz proposed the name *Sphoenohyla* as a substitute for Tschudi's earlier name *Sphaenorhynchus* [misspelled by

Lutz and Lutz as "*Sphoenorhynchus*"] which they believed to be preoccupied by *Sphenorynchus* Lichtenstein, 1823 [emended to *Sphenorhynchus* Auctorum!]. Inasmuch as Tschudi's name differs in spelling from all other nominal genera, it is not preoccupied in the literature as thought by Lutz and Lutz (1938:175-177) and Goin (1957:12). Consequently it must replace the name *Sphoenohyla* in the combination *Sphaenorhynchus aurantiaca, et al.*, by those who believe that the hatchet-faced frogs allied to *Hyla aurantiaca* Daudin deserve separate generic status from *Hyla*.

It must be pointed out that even if Tschudi's name is considered to be preoccupied through any changes in, or subsequent interpretation of the International Rules, the name *Sphoenohyla* Lutz and Lutz still cannot be used because it is an exact synonym of Fitzinger's 1843 name *Dryomelictes*, both names having the same type species. Moreover, *Sphoenohyla* has had no long period of usage as a generic name to justify its retention. It was used by Lutz and Lutz only as a subgeneric name, and Cochran (1955), in her review of the frogs of Southeastern Brazil, did not utilize the name even in a subgeneric sense. Goin (1957) elevated the name to generic rank. Therefore, *Sphoenohyla* cannot be considered to have become established in the primary zoological literature.

The following synonymy applies to the nominal genus *Sphaenorhynchus* Tschudi:

SPHAENORHYNCHUS Tschudi

Sphaenorhynchus Tschudi, 1838, Mém. Soc. Sci. Nat. Neuchâtel, p. 71 (original proposal of name; type species *Hyla lactea* Daudin [= *Hyla aurantiaca* Daudin, *fide* Duméril and Bibron, 1841, p. 612], by monotypy).

Sphaenorhincus Duméril and Bibron, 1841, Erp. Gén, vol. 8, p. 612 (erroneous subsequent spelling of *Sphaenorhynchus* Tschudi).

Dryomelictes Fitzinger, 1843, Syst. Rept., p. 31 (original proposal of name; type species *Hyla lactea* Daudin, by monotypy).

Dryomelictes Cope, 1865, Proc. Acad. Nat. Sci. Philadelphia, p. 194 (original proposal as new genus; type species "*Hyla aurantiaca* auctorum". by original designation).

Sphoenorhynchus Lutz and Lutz, 1938, Ann. Acad. Brasileira Sci., vol. 10, pp. 175-177 (erroneous subsequent spelling of *Sphaenorhynchus* Tschudi).

Sphoenohyla Lutz and Lutz, 1938, Ann. Acad. Brasileira Sci., vol. 10, p. 178 (original proposal of name; type species *Hyla aurantiaca* Daudin, by original designation and by reason of the fact that the name was proposed as a substitute for *Sphoenorhynchus* Lutz and Lutz, an erroneous subsequent spelling of *Sphaenorhynchus* Tschudi, which name was thought to be preoccupied by *Sphenorynchus* Lichtenstein, 1823 [Aves], emended to *Sphenorrhynchus* [Boie, 1828] and *Sphenorhynchus* [Wied, 1831, Gray, 1841, and Agassiz, 1846] [Aves]).

Spheenorhynchus Goin, 1957. Caldasia, vol. 8, p. 11 (erroneous subsequent spelling of *Sphaenorhynchus* Tschudi).

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FURTHER NOTES ON MIMICRY IN SALAMANDERS.—A summary of present knowledge concerning the apparent mimicry of *Plethodon jordani* subspecies by *Desmognathus ochrophaeus carolinensis* has recently appeared (Huheey, 1960, J. Elisha Mitch. Sci. Soc. 76 (2):246-251.

Bishop (1947, Herpetologica 3:178) reported specimens of *carolinensis* from Tusquitee Bald, North Carolina, which had red legs as do specimens of the sympatric *P. j. shermani*. This remarkable parallelism in color pattern has resulted in the general impression that all "imitators" from this area show only the red-legged pattern. However, Brimley (1928, Copeia 1928 (166):22-23) had reported "imitators" from this area which had both red cheeks and red legs, as well as two specimens with red cheeks only. We now report two additional specimens with red on the cheeks only. These two specimens (JEH 268-9), collected April 14, 1960, at Rattlesnake Spring on Wayah Bald, Macon Co., North Carolina, at an elevation of ca. 5,160 feet, were found under rocks and litter at the edge of the spring. Both had bright cheek patches and are indistinguishable from "imitators" from the Great Smoky Mountains. In addition, two *carolinensis* of normal pattern, several *Eurycea bislineata*, and two *Gyrinophilus danielsi* were obtained at this locality.

Another red-cheeked *carolinensis* was captured by H. C. Seibert, April 17, 1960, at Warwoman Dell, Rabun Co., Georgia. We have been permitted to examine and report on this specimen through the courtesy of Dr. Seibert (Ohio Univ. Vert. Coll. 3996). It is similar to those from the Great Smoky Mountains. Insofar as we are aware, this is the southernmost record for this color pattern in *carolinensis*, and lies within the range of *P. j. rabunensis*.

The presence of "imitators" in regions where models do not exist, and the presence of "wrong" "imitators" in regions where models do exist, presents some difficulties to the mimicry interpretation. However, if the aposematic condition in *jordani* is of recent origin (as evidenced by the fact that only two of the seven subspecies of *jordani* exhibit apparent aposematic coloration, and by the high variability in the pseudoaposematic coloration of *carolinensis*), no contradiction appears. Assuming that populations of red-cheeked *carolinensis* evolved in the Great Smoky Mountains (mimicking *jordani*), the genes for red cheek color could then have diffused into surrounding areas. The red cheek would probably have been selected against wherever red-cheeked *jordani* did not occur. That this may be the case is shown by the fact that even in the Great Smoky Mountains the incidence of red-cheeked *carolinensis* is strongly reduced at lower elevations (King, 1939, Amer. Midl. Nat. 21(3):531-582). However, within the range of the red-legged

shermani it is possible that the red-cheeked *carolinensis* may sufficiently resemble this form so as to receive a limited degree of protection. This slight protection from predators could explain the apparently greater incidence of red-cheeked *carolinensis* in this area than in surrounding areas, exclusive of the Great Smoky Mountains. Moreover, modifying genes, tending to make the color pattern more like that of *shermani*, would be selected for, and thus specimens are found with red legs and/or red cheeks. It may be that we are seeing the first stages in the evolutionary development of mimicry of *shermani* by *carolinensis*. Thus, at our present state of knowledge, these data neither confirm nor contradict the mimetic hypothesis.

In the previous report few animals were known to prey upon *jordani*. We should like to add one species to the meager list. On August 24, 1960, one of us (RAB), with Doris Brandon and Richard Russell, a park naturalist, found an adult *Desmognathus quadramaculatus* near the South Fork of Walker Camp Prong, Great Smoky Mountains National Park, at an elevation of 4,700 feet. Upon being uncovered, the salamander promptly disgorged a partially digested *jordani*. Although the anterior half of the body was missing, identification was possible, based upon the hind feet and tail. This record adds an amphibian to the list of reptiles, mammals, and birds known or suspected as predators, although it is doubtful whether salamanders would be important as selective agents with respect to possible warning coloration.—*James E. Huheey and Ronald A. Brandon, Department of Zoology, University of Illinois, Urbana, Illinois.*

A NEW RECORD SIZE FOR THE BLACK MOUNTAIN DUSKY SALAMANDER *DESMOGNATHUS FUSCUS WELTERI*.—A male specimen (USNM 142209) of *Desmognathus fuscus welteri* which after preserving measures 170 mm. in total length was taken on 24 June, 1959 from under stones in the bed of a small rapid brooklet on the north-west slope of "The Pinnacle," a peak of Cumberland Mountain within the Cumberland Gap National Historical Park. The site is at an altitude of only 1640 feet and lies three miles east of Middleboro, Bell County, Kentucky, a few hundred yards from both the Virginia and Tennessee borders.

Although its length is only four millimeters (2.4%) greater than the maximum reported by Barbour (Copeia, 1950 (2):277-8), the record raises an interesting question regarding Barbour's impression that "this race reaches its maximum size on Big Black Mountain, Harlan County, Kentucky, and Wise County, Virginia." The Pinnacle is approximately 50 miles from Big Black Mountain.—*A. J. Barton and H. Ross MacCallum, The Stony Brook School, Stony Brook, L. I., New York and Victoria University of Manchester, Manchester, Lancashire, England.*

NOTES ON EGGS AND YOUNG OF THE SCARLET KINGSNAKE, *LAMPROPELTIS DOLIATA DOLIATA*.—In the most recent account of the breeding habits of North American snakes Wright and Wright (Handbook of Snakes, Comstock Publ. Assoc., 1957: 354) stated in regard to *Lampropeltis doliata doliata*: "The breeding data is scanty. . . . There are no records of hatchlings." In view of the apparent lack of published information concerning the eggs and young of this relatively uncommon form, the following observations are presented. The numbers accompanying the specimens discussed refer to the State Museum Field Collection (SMFC).

On August 17, 1960, Mr. Perry Rogers discovered a clutch of six eggs in the center of a decaying pine stump standing in a burned-over wooded area 6 mi. E. Blackjack, Pitt Co., N. C. The eggs were adherent, and though Mr. Rogers took no detailed measurements at the time, he later estimated the eggs to be about ¾ x ½ in. One was opened in the field and found to contain a premature, though perfectly formed, *doliata* (645) which measures 136 mm. t-l in the preserved state. The remaining five eggs were placed in a glass jar containing damp sawdust and kept in the collector's home where on August 23 three hatchlings emerged. On the following day the two remaining eggs were opened, disclosing dead individuals, one of which is preserved (644). The other snake was discarded before I was able to examine it. It was described, however, as being deformed and colorless.

The three living specimens (651-653) were not received by the writer until August 30, eight days after emergence. At this time the snakes were placed in a glass terrarium provided with small pebbles covering the floor and several strips of bark under which the snakes remain most of the time. On August 31 each specimen cast the natal skin, and on September 1 over-all measurements were taken as correctly as possible. The juveniles measured 159.0, 159.0, and 146.0 mm. (mean 154.6 mm.) On September 3 a small *Eumeces inexpectatus* was introduced into the glass tank. Sometime later one of the kingsnakes was observed in pursuit of the skink, which was quite obviously much too large for any of the young snakes to consume. The lizard was removed from the tank and its tail was amputated and sectioned into two parts. Two of the *doliata* immediately ingested the portion offered them, and at present all three specimens are feeding regularly upon the caudal appendages of *Eumeces*. Earthworms and tails of *Anolis* and *Cnemidophorus* have thus far been rejected.

Appreciation is due Mr. Perry Rogers of Greenville, N. C., who collected the eggs and maintained notes until the material was released to the writer.— *W.M. Palmer, North Carolina State Museum of Natural History, Raleigh.*

ABERRANT REPRODUCTIVE BEHAVIOR IN FROGS.—Published descriptions of behavioral anomalies of frogs are rare in comparison with those of structural anomalies. An interesting deviation in the behavior of *Hyla crucifer* was observed in the laboratory on February 24, 1960. About two hours after three gravid *crucifer* and one gravid *Pseudacris triseriata* were captured in the field, they were placed in a pint jar. Shortly afterwards, one of the *crucifer* clasped the *triseriata*. She apparently was not holding intensely because 1.4 minutes later the *triseriata* moved forward about two inches and the frogs separated. Immediately the *crucifer* moved onto the back of a nearby *crucifer* and seized her firmly in the axillary region. The sides of the embraced frog were noticeably indented, thus indicating that considerable pressure was applied by the clasping female. Even though on several occasions the clasped frog slowly moved a few inches at a time, amplexus continued for 6.1 minutes.

This unusual behavior was goal directed and not the result of accidental movements in confined quarters. Gross internal examination of the clasping frog showed that she was a normal female; both ovaries were greatly distended with eggs. The only unusual characteristic of this frog was her behavior. About a half-hour prior to being placed in the jar with the other frogs, she gave a typical female reaction to a recorded mating call (Martof and Thompson, Behavior, 13:243-258, 1958). The change to male behavior was possibly triggered by the thwarting of her attempts to come into contact with a calling male. However, in other experiments several frogs were subjected to a similar situation for long periods of time and none showed deviate behavior.

Another instance of clasping by a female involved *Bufo americanus*. This time the circumstances were very different and the clasping more intense and prolonged. Four toads (one male, one gravid female, and two spent females) captured on March 26, 1960, were kept in a 1' x 1' x 2.5' terrarium. On the afternoon of May 11th, one of the spent females was observed mounted upon the large gravid female. The hold was axillary in position and was strong enough to bear the weight of the clasped toad when the other was lifted by her hind legs. Two hours later, the toads were still in amplexus. At that time they were placed in a large finger bowl containing water. Amplexus continued for about 1.5 hours longer. In the meantime the clasped toad made no attempt to spawn. Near Athens, Georgia, *Bufo americanus* usually spawn in February and March. Probably the eggs in the gravid female were partially absorbed. Dissection of the clasping female showed no atypical structures. The ovaries appeared to be normal; they contained many small developing ova. Sexual arousal appeared to play no role in this case of clasping, in contrast to that by the female *Hyla*.

It is interesting to speculate further on the causative factors producing male behavior in females. Among vertebrates such behavior may be evoked and even intensified by androgen treatment. Numerous cases of "reversals" of sexual behavior have been reported for fishes, reptiles, birds and mammals. Relatively few reports deal with amphibians. Female *Acris gryllus* injected with testosterone developed male secondary characters (Greenberg, Jour. Exp. Zool., 91:435-451, 1942). A. P. Blair (Jour. Exp. Zool., 103:365-400, 1946) induced clasping in juvenile female *Bufo woodhousei* by injections of various hormones, mainly androgens. In these two studies, the mating call was not induced by androgen treatment, contrary to Dorfman and Shipley (*Androgens*: Biochemistry, Physiology, and Clinical Significance. J. Wiley & Sons. 1956). The observations in the present report are important because they indicate that clasping occurs in female frogs without hormone treatment. The only germane reference found in the literature is in the introduction of Blair's paper (*op. cit.*). "Spontaneous clasping by female toads and by immature toads of as small size as 20-25 mm. body length has been observed (Blair, unpublished)." From studies of masculine behavior in normal females of numerous avian and mammalian species, Beach (Recent Progress in Hormone Research, 1:27-63, 1947) concluded that each individual possesses neuromuscular mechanisms capable of mediating both male and female mating patterns. Furthermore, these patterns can be evoked by estrogens as well as by androgens. Probably some amphibians, like many birds and mammals (and possibly numerous other vertebrates), are potentially bisexual in behavior.—*Bernard S. Martof, Department of Zoology, University of Georgia, Athens, Georgia.*

SIMULTANEOUS CONSTRICTION HABIT IN *ELAPHE OBSOLETA SPILOIDES*.—On June 22nd, 1960, at 4:45 p.m. an adult Gray Rat Snake (*Elaphe obsoleta spiloides*) was captured near the east arm of Phillips Inlet in Bay County, Florida. The specimen was stretched across a trail through sandy, pine and scrub oak land, covered with palmetto and wiregrass. During the next month and a half the snake was kept in a cage and fed white mice regularly. It was always aggressive and fed well.

The first double feeding occurred on August 8th with the snake constricting two mice at the same time, but I did not observe it closely. On August 17th I decided to again offer two mice and make a more detailed observation of the feeding. On that date an adult albino *Mus musculus* was introduced into the cage. The snake quickly seized the mouse and threw constricting coils around it. About three minutes later another *Mus musculus* was dropped into the cage. The snake, after releasing its oral hold on the first mouse, which seemed dead, seized the second and began constricting it;

consequently the snake was constricting two mice simultaneously for several minutes. Shortly the second mouse was dead and the snake swallowed it. The snake proceeded to drink from a water pan for some minutes and finally returned to the first mouse, which had been released from the coils during the ingestion of the second mouse. The first mouse was quickly swallowed.

Jameson (Copeia, 1956 (1):54-55) reports simultaneous constriction in *Elaphe subocularis* and *Pituophis catenifer deserticola*. In the present feeding, the snake was not noted to move the first victim posteriorily before seizing the second, as Jameson observed. Rather the two mice were side by side and in contact during the double constriction. As Jameson pointed out, it is naturally advantageous for the snake to get two normal-sized meals at the same time. The house mouse (*Mus musculus*) is very numerous in some areas, old barns and sheds; therefore in heavily infested barns a snake might frequently use this simultaneous constriction habit.—*James F. Jackson, 421 Poinciana Drive, Birmingham 9, Alabama.*

THE MOURNING GECKO IN THE AMERICAS.—Between January 30 and March 13, 1958, the junior author collected numerous reptiles and amphibians in the vicinity of Ft. Clayton, Canal Zone, Panamá. This collection, donated to the University of Illinois Museum of Natural History, contains a single subadult, 42 mm. s-v female *Lepidodactylus lugubris* Duméril and Bibron, often referred to as the Sad or Mourning Gecko. The specimen, Univ. Ill. Mus. Nat. Hist. No. 41811, agrees with descriptions of the species and with other examples at hand from Hawaii and New Caledonia.

Although the species is widely distributed in the western Pacific as far east as Hawaii, we are not aware that it has previously been reported from any lands on the eastern edge of the Pacific. With the voluminous traffic between the Canal and Hawaii it is not surprising that this species, with its known stowaway proclivities, should eventually become established on the American continent. It no doubt already is established at other points, as is strongly indicated by a specimen received by the Chicago Natural History Museum some three years ago from bananas shipped from Central or South America to Wisconsin.—*Hobart M. Smith and Chapman Grant, Department of Zoology and Museum of Natural History, University of Illinois, Urbana, and Route 1, Box 80, Escondido, California.*

ON THE TAXONOMIC STATUS AND THE GRANULAR PATCHES OF THE JAVANESE FROG *RANA CHALCONOTA* SCHLEGEL.—Since the establishment of the species *Rana chalconota* and *Rana labialis* by respectively Schlegel (Abbild. neuer oder unvollst. bekannte Amph. Düsseldorf: 23, 1837) and Boulenger (Ann. Mag. Nat. Hist., 19:345, 1887) the distinction between the two species has been controversial. Boulenger (Rec. Ind. Mus., 20:207, 1920) and Schyfsma (Treubia, 14: 43-72, 1932) consider *labialis* as a variety of *chalconota*, whereas van Kampen (Amphibia of Indo-Australian Archipelago: 217-222, 1923) considers the two as allied but different species.

While studying the breeding habits and development of *Rana chalcanota* I closely observed the variation of the adult frogs occuring around Bandung (western Java). Special attention was given to the characteristics which supposedly distinguish *labialis* from *chalconota*:

1) disc of second finger small and elliptic in *chalconota*, circular and not much smaller than ½-⅔ diameter of tympanum in *labialis;*
2) dorsolateral fold broader and more distinct in *chalconota* than in *labialis*; and
3) in tadpoles, papillae of lower labium long and prominent, and no round granular patches on the ventral surface behind mouth in *labialis*, not so in *chalconota*.

Measurements of the disc of the second finger and of the tympanum made by Miss Sie Kho Iem on specimens in the Zoology Museum of the Bandung Institute of Technology are shown in the accompanying table. It is obvious from these data that considerable variation occurs in size and shape of the disc of the second finger. Circular discs are not uncommon, and some are broader than long. Variation in shape of the disc of the second finger even in this local population reveals so extensive an overlap that distinction of the two species on the basis of this character is impractical.

The dorsolateral fold extends from just posterior to the eye to the base of the thigh. Contrary to van Kampen's diagnosis, about seventeen out of the thirty-five Javanese specimens have their dorsolateral fold narrow and rather indistinct.

In an earlier paper (Liem, Treubia 25: 89-111, 1959) I have shown that when the larval mouth is at the height of its development *chalconota* tadpoles (from Bandung) have their lower border labial papillae long and prominent, just as described for *labialis* by Flower (Proc. Zool. Soc. London: 903, 1896) and van Kampen The latter failed to indicate the developmental stage of the tadpoles he described of *chalconota*. Flower's description of *labialis* tadpoles fits perfectly the fully developed *chalconota* tadpoles. The two

circular granular patches on the ventral surface behind the mouth of Bandung tadpoles are sometimes very indistinct, but in all such individuals histological sections reveal the presence of the glands, which are simply much more scattered than in specimens with more distinct granular patches.

These observations on the Javanese population in their totality seem to provide supporting evidence for Boulenger's view (1920) that *labialis* is not a species distinct from *chalconota*. The conformation of *labialis* as a valid species or subspecies therefore awaits accumulation of new evidence not now available.

The eight granular patches found in tadpoles and young (1-2 weeks after metamorphosis) of *chalconota* (never in larger imagos)

TABLE I. Measurements of *Rana chalconota*

SPECIMEN	DISC OF 2ND FINGER		TYMPANUM	
NO.	WIDTH	LENGTH	WIDTH	LENGTH
1	1.2 mm.	1.1 mm.	4.2 mm.	3.1 mm.
2	1.1	1.1	4.7	3.6
3	1.2	1.2	4.4	4.1
4	1.3	1.3	5.0	4.5
5	1.0	1.0	4.1	3.1
6	0.9	1.2	4.0	3.6
7	1.2	0.6	4.0	3.2
8	1.3	1.0	4.0	3.0
9	1.2	1.3	3.8	4.0
10	1.3	1.4	4.7	3.8
11	1.5	1.3	4.5	3.4

appear histologically as accumulations of multicellular poison glands, resembling granular glands (Liem, 1959). Extracts of these granular patches have been injected intramuscularly into several specimens of *Fluta alba* fish and *Rhacophorus leucomystax* frogs. All *Fluta* specimens died between 7-16 hours, and all *Rhacophorus* between 3-8 hours after the injection of 10 cc. of the extract. These granular patches appear to be of great survival value for the species. Carnivorous fishes as *Fluta alba* and *Tilapia mossambica* in starved condition would not feed upon *chalconota* tadpoles, while the same fishes will feed eagerly on tadpoles of *Rhacophorus leucomystax*, *Rana limnocharis*, *Rana cancrivora* and *Rana erythraea*, all devoid of granular patches.

A breeding population of *Rhacophorus leucomystax* in an artificial pond was completely eliminated within a period of five months after the introduction of a mixed population of *Rana chalconota* and *Tilapia mossambica*. Partial elimination of the predation factor be-

cause of the presence of larval granular patches seems to contribute to the success and wide distribution in the Indo-Australian Archipelago of *Rana chalconota*.

I am grateful to Dr. Robert F. Inger for permission to study the specimens in the Chicago Natural History Museum. I am also indebted to Prof. Hobart M. Smith for critically reviewing the manuscript and to Miss Sie Kho Iem for her valuable help.—*Karel F. Liem, Department of Zoology, University of Illinois, Urbana, Illinois.*

NOTES ON TWO LARGE BROODS OF *HALDEA V. VALERIAE* (BAIRD & GIRARD).—In May, 1960, Mr. Richard Reich of Magledt Road, near Parkville, Baltimore Co., Maryland, presented the Baltimore Zoo with two large gravid female *Haldea v. valeriae* which he had collected on his property at the above address.

On August 10, 1960, the larger of the two snakes (294 mm., total length) gave birth to 14 young, four of which died within a few hours after birth. All of the remaining young shed the natal skins over the period August 11-12. A few days later all were killed, measured and preserved. The total lengths varied from 84 to 90 mm.

On August 13 the other female (248 mm., total length) gave birth to 11 young. These began sloughing on August 18 but, probably because of the dryness of their cage, none had completed the process by August 21. By this time three had died with the slough only partially cast. The rest were released. The three dead measured 82, 83 and 84.5 mm., total length. —*Frank Groves, Baltimore Zoo.*

A RECORD OF *ARIZONA ELEGANS EXPOLITA* FROM THE STATE OF AGUASCALIENTES, MEXICO.—In 1957, the senior author made a small collection of amphibians and reptiles in the State of Aguascalientes, Mexico. Among the animals obtained was an interesting example of the Chihuahuan snake *Arizona elegans expolita*. Described by Klauber in 1946, this snake heretofore was known from the three specimens forming the type series which had been taken in the State of Chihuahua, Mexico, and a fourth specimen reported by Tanner and Robison (1960, Herpetologica, vol. 16, p. 68) also from Chihuahua. Our example differs from the specimens available to Klauber and Tanner in having 25 rather than 27 longitudinal scale rows at midbody (a variation not unknown among other populations of the "*elegans*" complex); otherwise it agrees closely with the description of the subspecies.

The individual reported on here was taken on Sept. 12, 1957. It was picked up "DOR" on the paved highway, Mexico 45, one mile south of Juan Batista (Elev. 6200 ft.) at 8:57 p.m., having been killed moments before.

The following descriptive notes are based on this specimen (CAS 87403): Young female; standard (snout-vent) length 404 mm; tail 60 mm; tail length/total length 13; scales in 27-25-17 longitudinal rows; 197 ventrals; 42 subcaudals; 8 upper labials; 10 lower labials; 1 elongate loreal; 1 preocular; 2 postoculars; 2+4 temporals; 2 prefrontals; 43 blotches on body, 10 on tail.

Inasmuch as the holotype and two paratypes of this subspecies as well as the Tanner-Robison specimen were taken in the State of Chihuahua, the present record extends the range of the form more than 525 miles southward. This leads us to conclude that it is widely distributed throughout the Mexican Plateau region. *Benjamin H. Banta and Alan E. Leviton, California Academy of Sciences, San Francisco 18, California.*

ABERRANT MUDTURTLES, *KINOSTERNON FLAVESCENS*, FROM COAHUILA, MEXICO.—Ten specimens of *Kinosternon flavescens* were collected 14 miles east of Sacramento (about 21 mi. WNW Monclova), Coahuila, from a shallow, temporary pond, August 26, 1959, by Mike Duever, Phil Porzel and Kenneth L. Williams.

Except for an atypical juvenile, the carapace of the adults is greenish in color, because they are heavily infested with algae, and with the seams between the slightly thickened dorsal laminae notably indented. The two largest specimens have a carapace length of 125 mm. (♂) and 114 mm. (♀). Each plastron is typical in shape and with black pigment scattered over the surface.

The specimens are distinguished as *K. f. flavescens* as follows: plastron indented behind; stridulation organs well developed in males; 9th marginal about as high as 10th, but much higher than 8th. Using Hartweg's characters (1938, Occ. Pap. Mus. Zool. Univ. Michigan, 371: 1-5) as a guide, the following data are pertinent to identity (ratios expressed as %): anterior lobe/gular, ♂♂ 28-57, av. 43.5; ♀♀ 40-50, av. 44.4. Femoral seam length/posterior lobe width, ♂♂ 8-12, av. 9.2; ♀♀ 8-12, av. 8.8. Femoral seam length/posterior lobe over-all length ♂♂ 10-17, av. 12.7; ♀♀ 8-15, av. 11.2. None of the above fall into the range of variation for *Kinosternon flavescens stejnegeri* as given by Hartweg (*op. cit.*)

The single juvenile in the series differs in the length of the femoral seam, having ratios of 13.4 (with post. lobe width) and 22.5 (with post. lobe over-all length). The carapace is smooth and typical of the species. Thus it appears that the rugose, slightly abnormal carapaces of the adults may be the result of environmental factors. Possibly, as suggested by Dr. John Legler, the abnormalities are caused by the infestation of algae.—*Kenneth L. Williams, Department of Zoology, University of Illinois, Urbana, Illinois.*

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